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# Electrical World

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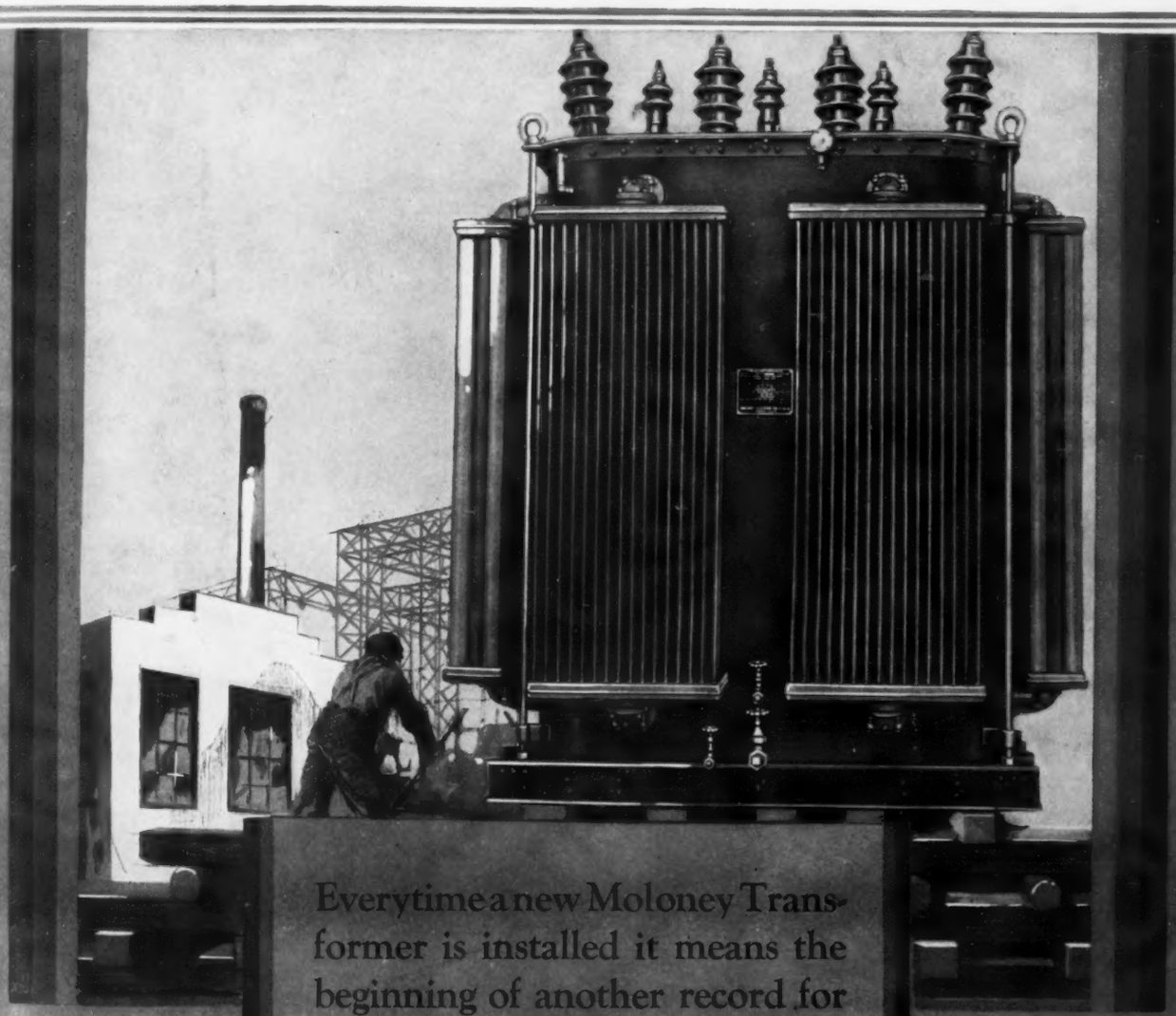

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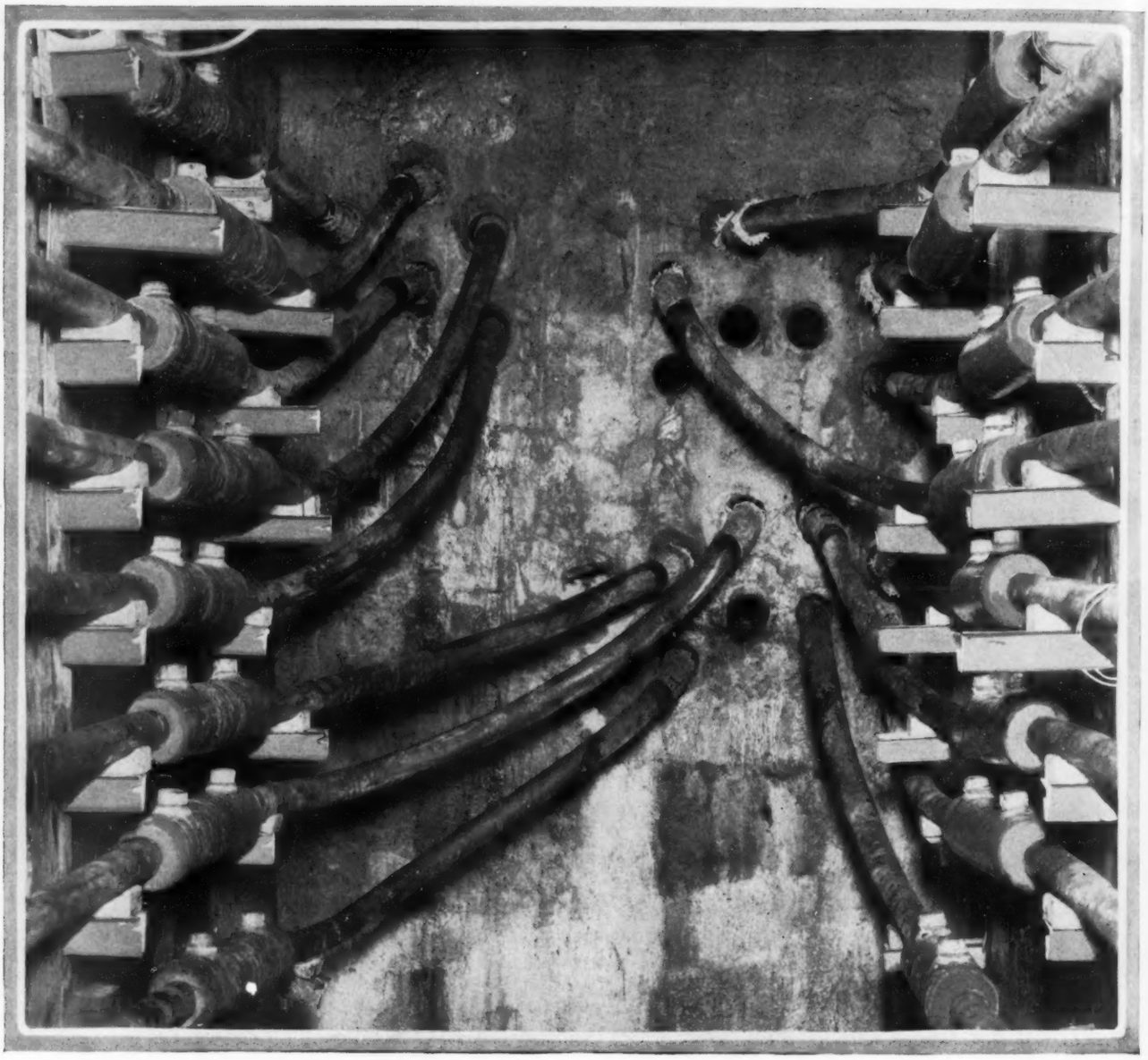

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# Electrical World

*The consolidation of Electrical World, Electrical Engineer and American Electrician*

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## *Output Data of Major Systems Available Soon*

THE ELECTRICAL WORLD'S annual tabulation of operating data on the major electric power systems in the United States and Canada will be available April 30.

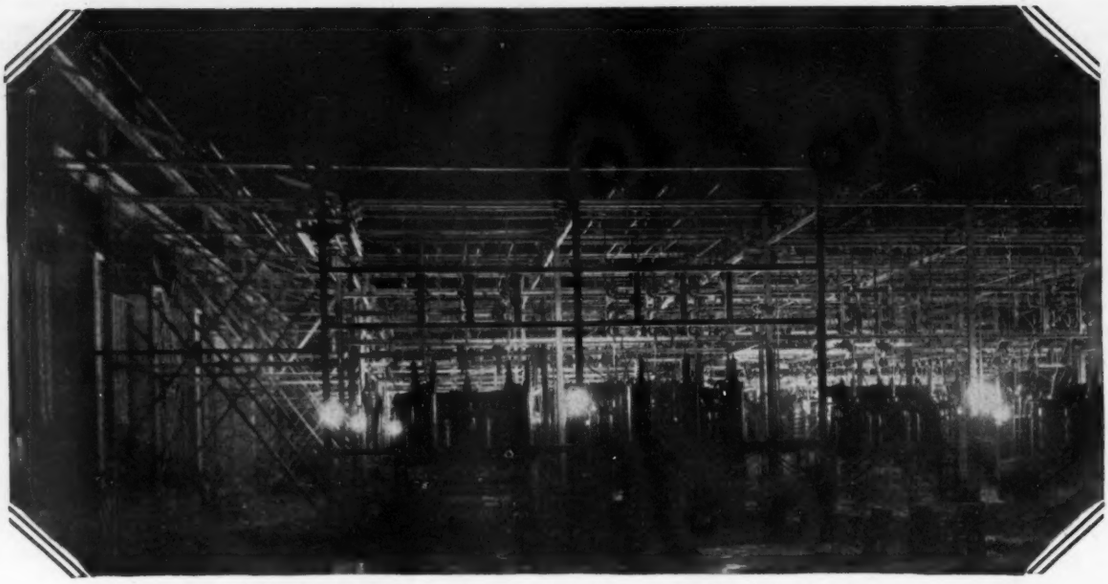
This tabulation will include statistics for all systems having an output exceeding 100,000,000 kw.-hr. in 1926; it embraces 150 systems, as against 129 for 1925. The number of electric service systems in the United States, of which there were 110 in last year's table, has grown to 124, despite the disappearance of several names from the list because of consolidations. From seven last year the Canadian companies have now come up to ten; there are fifteen railways in place of twelve, and a Mexican company appears for the first time.

The data account for more than four-fifths of the energy generated by the electric light and power industry in this country. The old figure was 80 per cent; this year the proportion will probably be even greater. The output of the largest system exceeded 4,000,000,000 kw.-hr.

The compilation was made possible by the 100 per cent co-operation of utility companies and systems coming within the designated classification. Inquiries were sent to cover all companies known or believed to be in the 100,000,000 kw.-hr. group; in every case, without exception, definite replies were received.

As before, there will be two tables, one giving detailed data for 1926 and containing more than 3,500 separate items, the other—of about equal size—affording comparative information for earlier years back to 1918.

**Advertising Index—Alphabetical, 106; Classified, 100, 102, 104; Directory of Engineers, 54, 55; Searchlight Section, 56-61**



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# Electrical World

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W. H. ONKEN, JR.
*Editor*

VOLUME 89 — *New York, Saturday, April 16, 1927* — NUMBER 16


## Television—an Engineering Achievement

DEMONSTRATION of television by the American Telephone & Telegraph Company at the Bell Telephone Laboratories on April 7 was an engineering achievement of the first magnitude—one which deserved the widespread acclaim brought to it by the popular nature of its appeal. Various experimenters in this field have in the past shown laboratory apparatus which it was hoped would sometime produce vision at a distance. The telephone engineers, avoiding premature announcements, have made their initial appearance in this field with surprisingly complete apparatus. With it they have actually demonstrated television in operation over hundreds of miles of intervening space. Not content with its demonstration by a single medium of transmission, they have shown television both by wire and by radio. They have also developed several forms of receiving apparatus suited to the varying requirements of individual employment, such as would be needed in an ordinary telephone conversation, and to perception of the distant object by a considerable audience.

It is noteworthy of television, as the telephone engineers have worked it out, that the solution follows closely the lines that inventors and prophets have visioned for at least a generation. The recent striking demonstration was not the result of any radically new discovery, but rather an achievement made possible by the general growth of science and technical contributions of a high order which have vastly extended the range of control of essential factors. Such, for example, are the photo-electric cell, the distortionless vacuum-tube amplifier and the transmitting networks of predetermined characteristics, without which the ideas of a few decades ago, however sound, could not have borne fruit. What the telephone engineers have done is to study intensively each element of the problem and apply to its solution the best means now available through modern science and engineering. It is an achievement of co-ordinated research and development of a kind possible only in a great research institution possessing facilities for the adequate study of every element of the problem. In the case of television these elements embrace everything from the details of terminal equipment, which can be studied in the laboratory, to a knowledge and control of the transmission characteristics of lines and radio channels.

Another aspect of this achievement of particular interest to engineers is the nice balance which has been struck between the goal sought—in this case the kind of scene which it has been chosen to transmit—and the limitations set by the physical means available. There has been much popular talk and discussion of transmitting such extended and complicated scenes as prize fights, stage performances and the like. Anything as extensive and ambitious as this would require the transmission of an enormous band of frequencies far beyond the present capacity of a single pair of telephone wires or any radio channel now available. To transmit clearly such a relatively small and simple object as the human face requires a much narrower band of frequencies and one reasonably within the possibilities of present knowledge. The fact that the peculiar problems of the telephone company are likely to be involved primarily with the adequate transmission of views of the human face makes its immediate television problem a simpler one than that which confronts those who seek to provide distant vision of a pageant. At the moment the television system which the American Telephone & Telegraph Company has worked out utilizes substantially the entire available transmission range of a high-class long-distance telephone circuit. As the demonstration showed, the rendering of the human face in animation is adequate, whether viewed in an individual apparatus or more than life-size on a screen.

The avidity with which members of the audience, and even the telephone company officials themselves, utilized the transmitted image as an adjunct to their telephone conversations with Washington indicated very forcibly the probability that television must in the future be considered seriously as a desirable addition to existing communication services. That it is ever likely to form part of the regular subscriber's telephone equipment is hardly probable, since the element of distant vision is not required in the great majority of conversations. That a limited number of special television terminals may be provided in each large center of population for use in connection with long-distance telephony seems, however, quite within the range of present engineering and commercial possibilities.

## The Chicago Election and Its Effect on the Illinois Utility Situation

INTERPRETATION of the result of the Chicago election which was held on April 5 is likely to vary. It was Chicago's most bitterly contested election in a generation, and it was the first Chicago election in a generation without a public utility issue. Always heretofore some public utility policy, detail or personality—municipal ownership, 70-cent gas, a five-cent fare, "no franchise grabs," or some "public utility magnate"—has been either a major or a minor issue. This time neither of the leading candidates for Mayor touched public utility questions except to promise prompt attention to street railways, which are operating under a six months' extension of expired twenty-year franchises. The circumstance is significant when it is recalled that Mayor Dever was a municipal ownership devotee four years ago and that Thompson, when Mayor before, was the avatar of "a five-cent fare."

The State Legislature has been expected to take up the indeterminate-franchise question, a hang-over from two years ago, at its present session. There is apparently no significant leadership and no organized opposition against the principle. But the "antis," as a counter-move, have worked up a couple of "home rule" bills intended to transfer utility regulation, more or less, from the state commission back to local municipal authority. The gesture, although ostensibly backed by a State League of Municipalities, has derived most of its importance from support by the city (Dever) administration in Chicago. Under the present state law in Illinois a municipality can, by referendum vote, resume a measure of local regulation of its public utilities. A proposal to effect this "home rule" for Chicago was put to a referendum vote on April 5 by the Dever city administration, but it failed to carry. Apparently there is no active, substantial sentiment for "home rule" over public utilities in Illinois.

Mayor-elect Thompson can be a factor in "home rule" and indeterminate-franchise legislation if and when these subjects are taken up at Springfield. Whether he will be, and how, are matters of conjecture. He is not committed on either subject. Virulent (for one reason or another) public utility baiters of his former entourage have been sloughed off. He is before everything else an opportunist. With the general public utility situation in Illinois apparently peaceful, and with sentiment in Chicago apparently favoring non-political adjustment of the street railway situation, expectation of acquiescence rather than disturbance from Mayor Thompson is not illogical.

## Good Results May Spring from Poor Criticism

ATTACKS on the electric light and power industry, dubbed by its organized traducers "the power trust," are breaking out afresh, like a spring rash. And like a spring rash they possess their irritating moments, but leave the patient somewhat better after the siege. For that reason, although not welcome, they must be endured. A critic, even though his judgment be at fault, may oftentimes contribute to the wellbeing of an industry, as witness the rural lines in Pennsylvania traceable to the impetuosity of the ambitious but unsuccessful Pinchot or the defeat of the Ford grab on Muscle Shoals by that arch-critic of the industry Senator Norris.

Fortunately, the industry has been wise enough to sift most of the charges and to hold fast and adopt the suggestions which are good. Many of the complaints are without foundation and are uttered for home consumption and effect. When Senator Copeland, for example, warns the people against leasing water power to privately owned public utilities, which would thereby wax fat and inordinately rich, he utters fairy tales, because there are no water powers of that kind in New York or any other state. This charge of growing rich at public expense through hydro-electric development forms the basis of most of the charges against the electric light and power industry. Of course, those who utter them do not possess one shred of evidence to substantiate their claims, and the only reason they are swallowed by a gullible public is because the electric light and power industry has not been zealous in making the facts known. This is a mistake, because water power is a matter on which there is abundant proof and this proof should be used by the industry to confound its critics. In other instances it is expedient that public utility companies give serious consideration to some of the charges made against them. As a progressive body the electrical industry must be alert to check every disposition to become self-satisfied and reactionary.

## Professional Societies and Standardization

WHAT part should professional societies play in a national standardization program? In a letter in this issue John C. Parker has stated admirably the thoughts of a large number of electrical men. His presentation and arguments convey the sincerity of purpose and ideals of service which make the American Institute of Electrical Engineers the essential capstone to progress in the electrical industry and which have gained for it the undivided loyalty of all electrical men.

But is the program announced by the Institute and discussed by Mr. Parker either wise or practicable? Should the national standardization program be focused in the professional societies, and is this program one that meets the needs of the situation? Standardization today includes technical definitions, test specifications, dimensional specifications, quality standards, safety and fire codes, commodity and purchase specifications and production simplification policies. Essentially the very large majority of standards are temporary commercial specifications which should be made quickly, changed quickly and be accepted heartily and unanimously because they pay producer, distributor and user.

According to available information, there are engaged in standardization work in this country forty-eight states, sixty cities, two hundred and three technical societies and trade associations, fifty-four government bureaus or boards and six or eight general agencies. And new organizations or agencies are clamoring to get into the game. These bodies spent about $8,000,000 last year in standardization work.

The center of gravity in standardization has shifted from the technical to the trade groups in conformity with the shift from basic technical standards to temporary commercial specifications. Again, if any one industry is studied, it will be found that many agencies are working on standards, and only in the electrical industry will the industry professional society be found holding a very high place in standardization. Some engineering societies in other industries have even adopted a policy of not making standards, because they feel that their efforts should be devoted to more professional tasks.

With this national picture in mind and the clear understanding of the fact that most national standardization work today must deal with specifications and agreements made between manufacturers and between manufacturers and buyers, there is a question as to the advisability and practicability of a professional society undertaking the industry-wide task of heading up all standardization work, even though jurisdiction be granted it by the standardizing agencies of the industry.

The alternative is for the professional society to initiate and make standards of the type it should and can formulate and to sit in at the making of any industry standard so that it may contribute its bit to the cause. With full freedom in the initiation of standards,

with the power of veto on any industry standard and with acknowledged jurisdiction on specific standards for which the need arises, there would seem to be a place and a job for major standardization work on the part of a professional society. A national procedure and policy on standardization work should be set up to give the fullest scope to this type of professional participation. The weight of evidence, measured in terms of industry needs and trends and the functional requirements in standardization, is against an industry standards program which makes a professional society the agency for the whole task.

## What Price Commercial Expansion?

IN MANY companies the commercial man has been challenged to open his throttle wide and to break all former speed records in "making the grade" of new business getting, but even where the higher executives hold broad ideas upon commercial development the sales manager has not been authorized to inflate his payroll and sail away like a balloon in a gale. Granted that the light and power industry is hitting a faster stride in business building, the stubborn truth exists that many "doubting Thomases" among executives remain to be convinced that sales department outlays are not mounting too rapidly.

Every progressive sales manager should have in hand as soon as possible a picture of the immediate load-building possibilities of his territory to show his superiors when asked to justify departmental expansion. Survey material, however, is not enough to meet the requirements of many higher executives. These men demand data on the cost of getting new business, and while accurate information on this line is sometimes buried in the rush of daily work, it can generally be obtained with reasonable speed if the need is made clear and if overhead costs are intelligently allocated. Needless to say, justification of sales costs requires a thorough understanding of departmental outlays in time as well as in money, able scrutiny of these costs in relation to results obtained, a fair idea of the value of different classes of business to the company, and, last but not least, the ability to defend the department against being overloaded with charges that may properly be allocated elsewhere.

To cite a few instances of the actual cost of obtaining new business: Company A secured $40,000 worth of industrial lighting revenue last year at a sales cost of $4,000; Company B is about to close an agreement for the co-ordinated and improved lighting of every municipal building of a city of 50,000 population at a cost of $1 in sales expense for every $7 in revenue received in the first year of the revised service; Company C lately obtained a hundred-thousand-dollar industrial power contract at a sales outlay of only $500, thanks to an ably conducted new-business department under centralized management, and Company D spent only $1.31 in one year per $100 of new-business revenue secured. These cases exhibit wide variations in commercial department "operating ratios," but such data are convincing to the open-minded executive, along with plotted curves of business development and expenses set against time. The fact that in a vast number of cases sales expense practically ceases during the first year, leaving a permanent revenue increase, should also be noted in casting a balance between outgo and intake in sales department functioning.

## The Opportunity Before the Jobbers

UNUSUAL interest is growing around the coming convention of the Electrical Supply Jobbers' Association, which will meet the first week in May at White Sulphur Springs. Not only the wholesalers but the manufacturers have been feeling concerned over the status of distribution in the electrical industry. Changing times have upset many traditions in the flow of goods. The jobber has been harassed by many problems, both economic and political, involving his relationships with the manufacturers, the power companies, the contractors, the dealers and the other wholesalers. Moreover, there have been more jobbers outside the association than in it, in point of numbers though not in volume of sales, and the association itself has clearly fallen behind the march of events and is not providing a type of organization in balance with the other major branches of the industry.

Other organizations—the power companies, the contractors and the manufacturers—have all reorganized their national associations, heading them with strong, virile paid executives as managing directors to give active leadership to policies of outstanding presidents elected from the industry. But the jobbers' association has continued as a committee activity with no president whatever. And this has meant that there is today no recognized official national leader to speak for distribution in the councils of the electrical industry.

The first move toward a reorganization of the jobbers' association came last fall in a mild insurrection by a group of the smaller so-called "independent" members, meaning houses not affiliated with either the Graybar, General Electric or Westinghouse groups. As a result the qualifications for membership were made more liberal, the intent being to bring more small jobbers into the association and make it more fully representative. Meanwhile there has been a very active discussion of the advisability of a more sweeping reorganization and the election of a president and vice-presidents. Men are realizing more and more that a militant policy is needed. They wonder where they could find for president a man of the necessary attainments who could give the time it would require. That problem can be solved, however, just as in the other associations by the appointment of a full-time, paid managing director drawn from the industry who would be all that the title implies. And there is no executive among the jobbers too big or too important for the job, for he must undertake no less than to simplify the process of distribution in the electrical industry and to reduce its cost and in so doing to restore jobbers to economic health.

There is one other need also. At present, in the main, only the executives attend the jobbers' meeting, and they naturally discuss executive problems. The sales managers, the service managers and the warehouse managers have no part in it. They are denied the benefits of contact, co-operation and the exchange of experience in working out the practical operation of these basic functions. It would be a most constructive thing if in the hoped-for reorganization of the E.S.J.A. executive, sales, service and warehousing sections could be formed, the warehouse and service men to meet perhaps but once a year and go to work on a broad national basis to improve these essential practices of distribution. There will be many eyes turned on the jobbers as they gather at White Sulphur, for they have never faced a more important or appealing opportunity.

# Charles Irving Burkholder

*A far-sighted pioneer in hydro-electric and transmission-line development who has rendered invaluable service to the rapid growth of North and South Carolina*

TO THE remarkable growth of the Southern Power Company's system in North and South Carolina several factors have contributed. Prominent among these are the financial assistance and business acumen of the late James B. Duke, with his vision of developing Southern industries; the engineering genius and executive ability of W. S. Lee, and the sound judgment, practical experience and operating and management ideals of C. I. Burkholder. The accomplishments of these men, based upon the untiring efforts of themselves and the able staffs they built up, without outside assistance or the absorption of other organizations, have few parallels among achievements involving the design, construction and operation of large generating and transmission systems. When Mr. Burkholder joined the company in 1906 the maximum load was 800 kw. and the installed capacity 6,600 kva. Today the maximum load is 340,000 kw. and the installed capacity is 732,425 kva., with an output in 1926 reaching 1,430,000,000 kw.-hr.

Mr. Burkholder was born Oct. 9, 1872, at Sterling, Ill. In 1896 he was graduated from the University of Wisconsin with the degree of electrical engineer. The next year he spent as a civil engineer in Wisconsin. The following year was spent in Peoria, Ill., with the Diamond Meter Company, pioneer of the induction-type meter. In March, 1898, he entered the student course of the General Electric Company at Schenectady. It was about this time that the 11,000-volt line was built between the Mechanicsville hydro-electric plant and the General Electric Works, and this project gave him his first experience in transmission. Afterward he was put on the work of equipping machine tools with motor drive, necessitating a great deal of study of motor characteristics and applications. He then became assistant to A. L. Rohrer, electrical superintendent, acquiring experience in power-plant and transmission-line operation. His success in changing the 11,000-volt lines around Schenectady to 33,000 volts paved the way for his joining the Southern Power Company in November, 1906, as operating manager in charge of transmission lines, power houses and substations. In 1910 he became general manager, and in 1918 he was made a vice-president with direct supervision over all electrical construction, operation and power sales.

Mr. Burkholder is one of the fifteen trustees of the Duke Endowment, of which the Southern Power Company as well as other affiliated companies form an important part. He is a member of the A.I.E.E.

*Observations on*

# Pole-Top Switch Tests

## Series of Tests on Various Makes of Air-Break Switches Carrying Currents Up to 480 Amp. at 22,000 Volts Indicates Desirable Design Features to Meet Operating Conditions

**By Raymond C. R. Schulze**
*Engineering Department, Duquesne Light Company*

A LONG SERIES of tests on various makes and types of pole-top air-break switches was recently completed by the Duquesne Light Company. The principal purpose was to study their load-breaking characteristics and design features that affect their arc-forming and arc-dissipating characteristics. In general, the switches were required to close on a load and then open it. The current which the switch was required to open varied between 300 and 480 amp. per phase on different tests, at 22,000 volts. Water rheostats were used to regulate the load, and consequently the power factor was close to unity. Tests were conducted not only on switches now in production but also on various modifications of these switches. A number of new ideas were tried out. Since motion pictures and oscillographic and field data were obtained in a large number of cases, it was possible to analyze thoroughly the behavior of the various switches and determine the effect of their design on their arc-breaking ability.

The first series of tests was made on four switches, the object being to open the magnetizing current of a 20,000-kva. bank of transformers at 22,000 volts. This current amounted to only 10 amp., but the power factor was very low, so the arcs were consequently harder to break than high power factor arcs of the same current.

Three of the switches opened the magnetizing current arcs successfully, whereas the fourth switch short circuited on the only test made on it. These switches were mounted just as supplied by the manufacturers, no wider phase spacing or other changes being made.

Tests on the switches, using currents in excess of 300 amp. at 22,000 volts, were then started. The first tests were made with the switches as they were shipped from stock. Some tests were successful, but a large number were not; the failures in general being caused either by all three arcs blowing into a three-phase short circuit or by one arc being blown or swung down across an insulator to ground. In nearly all cases a line-to-line short circuit would quickly blow into a three-phase short circuit. A few cases occurred where a short-circuit arc would blow itself clear, but these were rare. The oscillograms showed that the three-phase short-circuit current was always slightly greater than the line-to-line short-circuit current. The velocity of the wind on all tests varied from 0 to 20 miles per hour.

### Phase Spacing Increased

The next step was to increase the phase spacing. Some switches were increased to 7 ft. between phases; others varied between 5 and 6 ft. This increased phase spacing helped somewhat, but failures continued to occur. Considering that in one case a failure occurred due to an arc being blown out to a length of over 15 ft.—the wind having been almost in line with the switches—it is evident that in order to prevent failures by short circuit a phase spacing of 20 ft. would be required. However, with a 7-ft. phase spacing, one switch—the one with most tests on it—had only one failure in 28 operations, or was 96.4 per cent correct.

The tests with increased phase spacing were continued, all the switches using 7 ft. between phases except two, one at 8 ft. and one at 9 ft. In general, a 7-ft. phase spacing on any switch increased the percentage of correct operations to 75 per cent or more.

The switches tested so far included both the vertical

and horizontal single-break types and the horizontal double-break type. The single vertical-break type of switch was present in several different forms. The next thing was to experiment with various changes in design. One manufacturer, at our request, assembled a double vertical-break switch. It operated satisfactorily, although no marked advantages over the single vertical-break type were noted. The additional weight and complexity of the double vertical-break type, therefore, eliminated it from the list of approved switches.

### "SNAPPING HORNS" TRIED

The next variation was a single vertical-break with longer moving horns; the end of the stationary horn was rounded, and the ends of the moving horns were left "springy" and formed into rings. This switch, when opening, gave a much longer arc and, in addition, the ends of the horns, being springy, snapped back when the rest of the mechanism stopped, thus giving a high speed of movement of the horn at the end of the

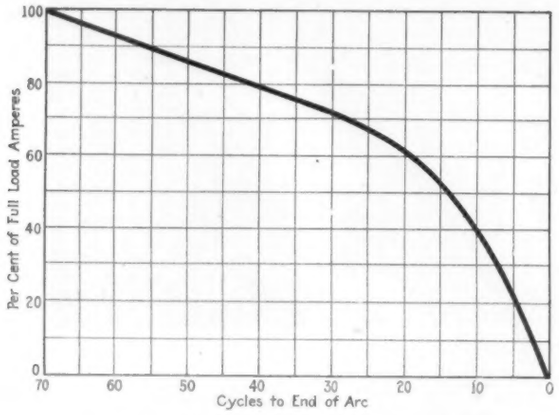



FIG. 1—RATE OF DECAY OF ARC CURRENT

stroke. This "snapping back" seemed to snap the horn away from the arc. Also the fact that the tips were ringed instead of pointed gave the arc a surface to play over, instead of confining its heat at a point, thus reducing the amount of copper vapor in the arc and making it easier to extinguish. This switch was the best one electrically of those on test, although the long, springy moving horns made it weak mechanically.

Another manufacturer, at our request, made a set of "snapping horns" for his switch. These horns were made of spring brass and were so arranged that the tips caught and held together until the mechanism was half way open; then the tips parted and snapped back, giving a high speed of parting at the beginning of the stroke. However, an examination of the data showed that the operating characteristics of this switch were no better than those of the same switch with stiff, non-snapping horns.

### DESIRABLE CHARACTERISTICS CANNOT BE COMBINED IN ONE SWITCH

These tests showed conclusively that any air-break switch of a practical design could not be guaranteed to open a load current of any magnitude under all weather conditions. However, a properly designed switch could be expected to open a current not exceeding 300 amp. at 22,000 volts about 90 per cent of the time, providing a phase spacing of at least 7 ft. is maintained, and lower currents should be opened successfully a greater percentage of the time.

The first lesson to be learned from these tests is that the lightness and compactness desirable in a switch for opening dead lines cannot be combined with the arc-dissipating qualities essential to a switch for opening load currents. This suggested the possibility of two distinct classes of pole-top switches—"line-sectionalizing" and "load-breaking" switches. The characteristics of these two classes can be listed as follows:

*Line-Sectionalizing Switches.*—Line-sectionalizing switches are to be used only to open dead sections of line or to open a closed loop. They are not expected to open any load current. These switches should have the following characteristics:

Light weight.
Simple, rugged construction.
Mountable on a single pole.
Self-cleaning main contacts.
Clamp and lug connections.
Operable under any weather conditions. (The contacts shall not freeze.)
No toggles (or the toggles shall be so arranged that they cannot lock the switch shut).
Horns should part at the tips so that if the switch does accidentally open a load current, the failure will be a short circuit rather than a ground.

*Load-Break Switches.*—A load-break switch is here defined as one that will open loads up to 300 amp. at 22,000 volts successfully on at least 90 per cent of its operations. The tests performed have shown that the arc produced when an air-break switch opens is reduced very little by refinements in design. That is, after a switch having the desired characteristics is obtained additional refinements in design make very little difference in the performance of the switch. The best design of switch will form as small an arc as possible in the least dangerous place and the best installation will spread out the phases so that the arc formed will not jump across. This means that a structure such as the top of a transformer bus structure is necessary on which to mount a load-break switch. Phase separation is the only way to prevent short circuiting of a load-break switch under any and all weather conditions.

A load-break switch should have the following characteristics:

No excess weight.
Simple, rugged construction.
Self-cleaning main contacts.
Clamp and lug connections.
Operable under any weather conditions.
No toggles (or they shall be arranged so that they cannot lock the switch shut).
The horns shall part at the tips so as to form the arcs high up off the ground.
The moving horns should have the fastest motion at the end of a stroke, and the end of the horn should be rounded and arranged to snap.
Phase spacing should be not less than 7 ft. and if possible should be more.

### DESIRABLE DESIGN FEATURES

The tests brought out a number of interesting points with reference to the design of air-break switches, which will be discussed in the following:

*1. Vertical vs. Horizontal Break.*—There is not much choice between a properly designed horizontal-break switch and a properly designed vertical-break switch. The vertical-break switch, however, is preferred. It showed up better on tests and seems to operate more consistently.

*2. Single vs. Double Break.*—The single-break switch is better than the double-break switch for two reasons, simplicity and more reliable operation. Single and

double-break switches were used with both vertical and horizontal breaks, and in all cases the single-break switch performed better than the double-break switch.

*3. Points at Which the Arc Is Formed.*—On some switches the arc forms at the base of the horns, whereas on others it forms at the tips of the horns. In several cases it was found that the arcs cannot be depended upon to rise up the horn of their own accord, therefore it is better to have the arcs form at the tips of the horns. This not only makes sure that the arc will reach the tops of the horns but it also greatly reduces the possibility of its going to ground. A switch on which the arc forms at the bases of the horns must be opened very slowly to insure correct operation. Having the arcs form at the tips of the horns eliminates the human factor as far as speed of operation is concerned.

The effect of rapidly opening a switch on which the arcs form at the base of the horns was shown by a study of one particular type of switch, which was so constructed that the arcs had to form at the bottom. If the switch was opened slowly, the arcs had time to follow the horns to the tips and consequently reached the top and usually opened satisfactorily. However, if the switch was opened quickly, the arcs could not follow the horns to the tops and there was danger of the arcs going to ground. Due to the arrangement of the operating mechanism on this switch as arranged for the test, it is not possible to say just how a "slow speed" of operation would compare with the speed of opening when operated by one man in the field. It is believed, though, that this switch could be opened more quickly as set up for test than it can be in normal operation.

*4. Speed of Movement of Horn (see item 3).*—A switch on which the arc forms at the tips of the horns can be opened at almost any speed, whereas one on which the arcs form at the base of the horns must be opened slowly. The question of relative speeds of the horn at different parts of the stroke is discussed under item 11.

*5. Construction of Tips of Horn.*—One switch when revamped had rings on the tips of the horn, and in addition the last foot or so of the horn was rather flexible. Using a round tip instead of a pointed tip provides the arc a surface over which to play. This tends to reduce the heating at the point where the arc is formed and consequently reduces the amount of ionized metal in the arc. Having the end of the horn flexible and the weight of the ring on the end of the horn allows this part of the horn to snap back when the horn itself stops. This seems to have the effect of snapping the horn loose from the arc. This particular switch has the most consistent operation of any one on test and it is believed that this construction of the tip of the horn is the best one found so far.

*6. Effect of Power Factor.*—Tests were made at a very low power factor and also at almost unity power factor. However, the current values used at these two power factors were so widely different that the tests are not comparable so far as power factor is concerned. Anyway, it is known that a low power factor arc is much harder to open than an arc the power factor of which is close to unity.

*7. Insulators Used.*—Although each manufacturer of pole-top switches has a certain insulator which he considers as standard for his equipment, they will all use any insulator the customer specifies for the equipment. Therefore the flashover values given by manufacturers in their detailed descriptions of switches simply represent the flashover values of the insulators used on the switches at the time they were tested. However, the minimum distance across the switch and therefore the flashover values across the switch with one side grounded must be carefully watched.

*8. Flashover Value of the Insulation.*—The flashover value of the insulation of an air-break switch should be higher than the flashover value of the line insulators for two reasons: (1) An air-break switch connects two sections of the line; to repair it means taking the section of line on each side of the switch out of service. (2) In case the switch is open to protect workmen and the live side of the switch flashes over, the arc is likely to communicate to the dead side of the switch and electrocute the men working on the line. It is needless to say that the flashover across the switch, with the switch open and one side grounded, should be higher than the flashover across either insulator to ground.

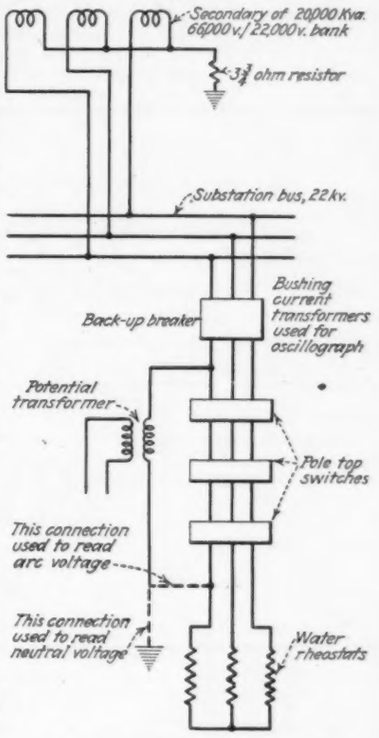

Secondary of 20000 Kva. 66000 v./22000 v. bank
3¾ ohm resistor
Substation bus, 22 kv.
Bushing current transformers used for oscillograph
Back-up breaker
Potential transformer
Pole top switches
This connection used to read arc voltage
This connection used to read neutral voltage
Water rheostats

FIG. 2—CONNECTIONS OF TEST EQUIPMENT

*9. Stability of the Arcs.*—The oscillograms show that the arcs are very unstable. Quite frequently with small values of current the arc will almost extinguish and then re-establish. Under larger current conditions the arcs are more stable on account of greater volume of ionized gas. However, in several cases the heavier arcs cleared themselves before the circuit breaker opened.

*10. Voltage Drop Across the Arc.*—There is a considerable voltage drop across the arc. Under short-circuit conditions this voltage will vary between 2,000 and 5,000 volts in most cases. With load currents only, the voltage across the arc will vary from zero to 7,000 volts. System connections were such that when a switch failed, the short-circuit current did not exceed 1,400 amp. This shows quite clearly that the voltage to ground in case of a three-phase short circuit caused by a flashover is considerably more than zero. From this it appears that the ground chain ordinarily used on high-tension lines does not afford complete protection to the men working on the line.

In a number of cases the first half cycle of voltage after the arc had broken exceeded the normal voltage. In one case this voltage reached the value of 1.52 times the normal voltage to neutral. The same occurrence was noted on circuit-breaker tests.

*11. Rate of Decay of Current from Instant Arc Forms.*—The variation of the current in the arc with time was noted on some correct operations. In general, the current remained constant for about a second, or

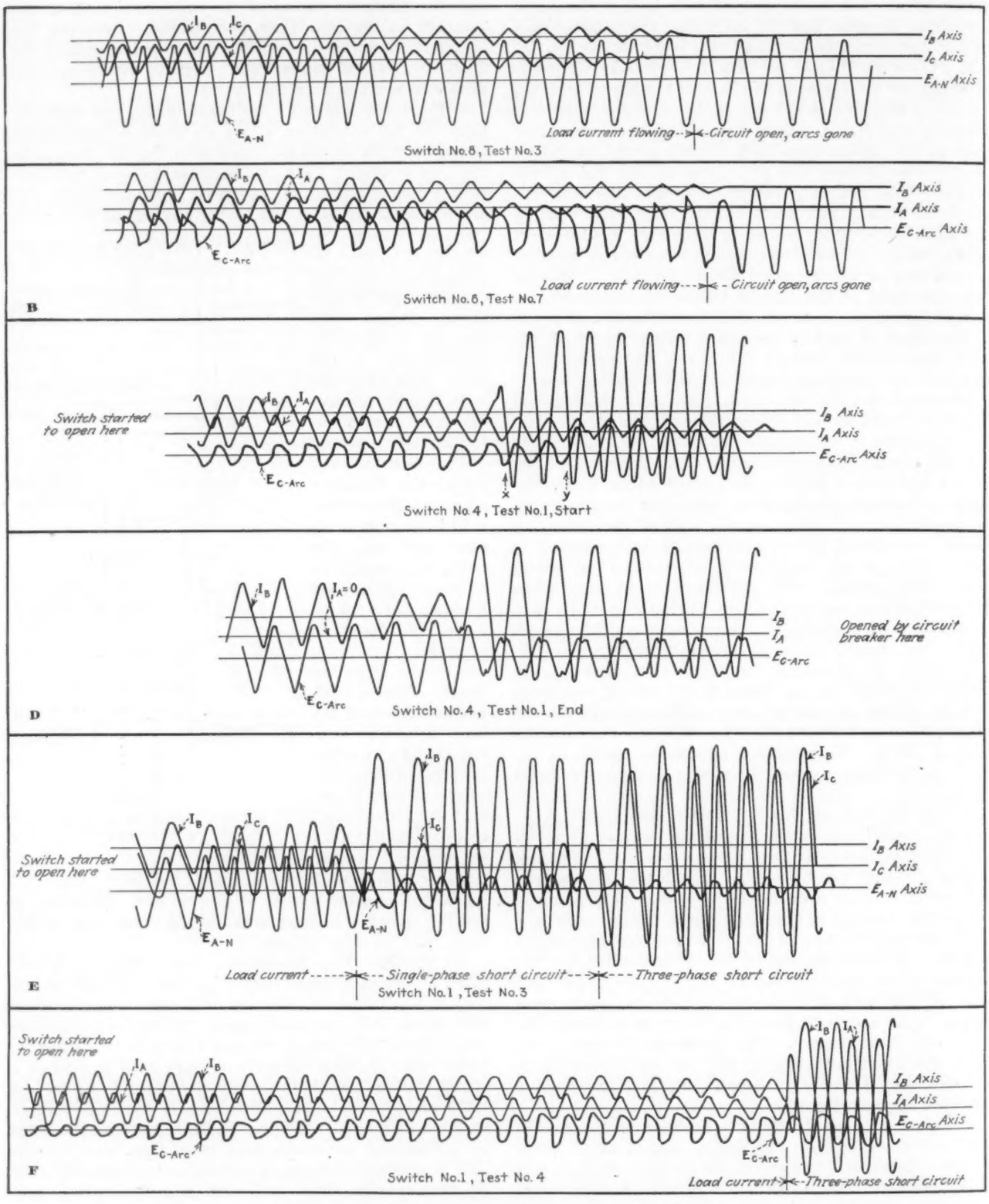



FIG. 3—OSCILLOGRAPHIC RECORDS OF SOME SWITCH TESTS

A—This shows a successful test. The currents gradually decrease to zero, when the arcs disappear. The voltage is from one line to neutral, and maintains a sine wave form.

B—This also shows a successful test, but here the voltage curve is the voltage across one arc. All three arcs broke at the same time.

C—This oscillogram shows the formation of a single-phase line-to-line short circuit at point *X*, The voltage, to point *Y*, is across the arc in *C* phase; at point *Y* the neutral bus of the water rheostats became grounded, as shown by the sine wave form.

D—This is a continuation of *C*. The *A*-phase arc has cleared itself, and the *B*-phase arc has almost cleared, when it re-establishes at full short-circuit value. At the same time the neutral bus of the water rheostats has apparently cleared itself, as shown by form of voltage wave.

E—This oscillogram shows the normal load currents, with voltage to neutral, then the formation of a single-phase line-to-line short circuit, and finally a short circuit between the three phases of the system involved.

F—This oscillogram shows the voltage across the arc gradually increasing as the current through the arc decreases, and then the formation of a three-phase short circuit.

**Characteristics on Which Comparison of Switches Was Based**

Insulators:
- Number moving.
- Number stationary.
- Total on switch.
- Strains on moving insulators.
- Hardware, clamped or cemented.
- Type, manufacturer.
- Flashover (dry).
- Flashover (wet).

Horns:
- Phase spacing, center-to-center.
- Distance between tips when open.
- Minimum clearance across open switch.
- Metal used in horns.
- Movement of horns.
- Rigid or springy.
- Arc forms.
- Do horns touch all the way up?
- Alignment.
- Protection to main contacts.
- Flexible leads.

Main Contacts:
- Type.
- Metal used.
- Alignment.
- Sleet hoods.
- Possibility of arc touching them.

Method of Mounting and Operation:
- Frame or single-pole units.
- One or two poles.
- Spacing between poles.
- Movement of operating lever.
- Toggles in mechanism, which may jam?

Miscellaneous Items:
- Material, use and number of:
  - Through bolts.
  - Tap bolts.
  - Set screws.
  - Cotter pins.
- All iron parts galvanized?
- Weight.
- Lug or clamp connections.
- Ease of adjustment.
- Effect of ice and sleet.
- Novel features.
- Soldered joints.

possibly until the moving horn had reached the limit of its swing, then as the arc bowed upward the current gradually decreased for another second or so, and then quickly dropped during the last half second or so. These data, plus the knowledge of the operation of different types of switches, show that the speed of operation of the switch during the first part of the opening is immaterial. However, a quick movement of the moving horn at the end of the stroke is advantageous.

The effect of the speed of movement of the horns was shown by the behavior of two special switches. The switch with snapping horns had a very high speed of break at the beginning of the stroke; this switch, however, behaved no better than the ordinary type. The switch with the long flexible tips on the horns had a high speed of movement of the tips, due to the tips snapping back when the horns themselves stopped. This snapping action seemed to break the tip loose from the arc; the arc, being drawn out, could not so easily re-establish itself. This switch had the best "arc-breaking speed" of the switches tested. Therefore it is desirable to have the horn move fast at the end of the stroke, whereas the speed at the beginning of the stroke is immaterial.

*12. Wind Velocity.*—When the tests were started, it was believed that a light breeze—about three to five miles per hour—across phases was the worst possible wind condition. As the tests progressed, however, and velocities up to twenty miles an hour were encountered, it seemed as though the higher velocities were worse. It is impossible to say just what the most dangerous wind velocity is—there is no outstanding velocity that is worse than any other—but it is believed that the worst velocity is closer to 30 miles per hour than to three miles per hour.

### Basis for Mechanical Analysis

Each switch tested was analyzed mechanically in accordance with the outline above. This served to provide a basis on which to judge the various switches for their mechanical features and provided material on which to base the ratings.

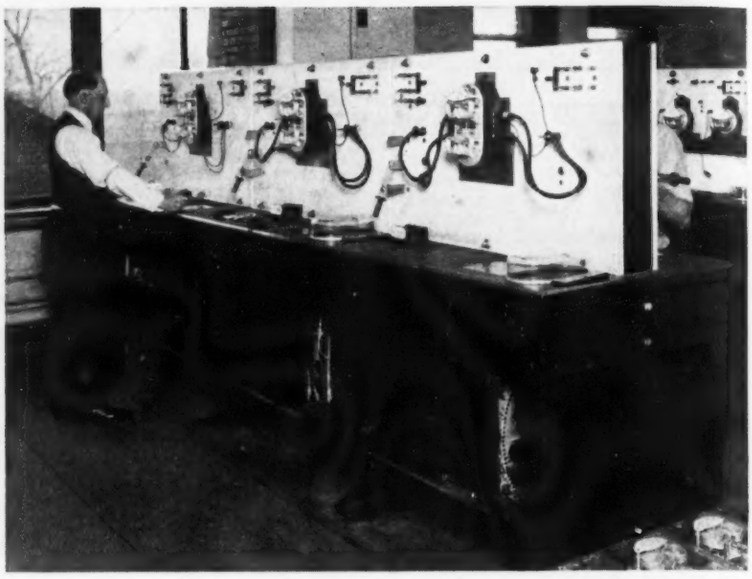
There are certain features, aside from the load-breaking ability, which are desired, and necessary, in an air-break switch. In addition to the things already mentioned, the switch must operate under any weather conditions. Its contacts must not freeze shut and they should be self-cleaning. If toggles are used, they must be so arranged that they cannot lock the switch shut. Connections from line to switch should be by clamp and lug, to give mechanical and electrical strength.

## Meeting the Power Needs of the Canadian Mining Industry

**VIRTUALLY the whole of the power needs of the mining industry in northern Ontario are met with hydro-electric power, and the same will be true of the new mining field in northwestern Quebec when the transmission line now being built to serve that district is completed. The table lists the stations from which power is served to the mines. It will be noted that an installation totaling almost 132,300 hp. is so utilized. About 50,000 hp. of this is for nickel-copper mining and smelting in the Sudbury district, roughly 20,000 hp. for silver mining in Cobalt, Gowganda and South Lorrain, and the remainder, 62,000 hp., is used for gold mining in the Porcupine, Kirkland Lake, Larder Lake and Goudreau fields. A part of the 62,000 hp. will also soon be available for use in the copper-gold properties of Rouyn, in northwestern Quebec. Besides, there is 168,000 hp. in the territory installed in connection with the pulp and paper industry, which in itself is a large consumer of electrical energy.**

CANADIAN ELECTRIC STATIONS DISTRIBUTING POWER FOR MINING

| Company | Installed Hp. |
|---|---|
| Algoma Power Company | 1,600 |
| Algoma Steel Corporation | 2,400 |
| Goudreau Gold Mines, Ltd | Non-generating |
| International Nickel Company | 13,800 |
| International Nickel Company | 7,500 |
| Total | 21,300 |
| Lorne Power Company | 7,550 |
| Lorne Power Company | 4,800 |
| Total | 12,350 |
| Wanapitei Power Company | 6,300 |
| Wanapitei Power Company | 3,600 |
| Wanapieti Power Company | 7,000 |
| Total | 16,900 |
| Northern Ontario Light & Power Company | 1,080 |
| Northern Ontario Light & Power Company | 5,340 |
| Northern Ontario Light & Power Company | 3,000 |
| Northern Ontario Light & Power Company | 13,200 |
| Total | 22,620 |
| Gowganda Power Company | 800 |
| South Bay Power Company | 600 |
| Canadian Associated Gold Fields | 1,600 |
| Canada Northern Power Corporation: | |
| Northern Canada Power, Ltd | 14,900 |
| Northern Canada Power, Ltd | 4,900 |
| Northern Canada Power, Ltd | 20,000 |
| Northern Canada Power, Ltd | 8,000 |
| Total | 47,800 |
| Great Northern Power Company (operated by Northern Canada Power, Ltd.) | 4,000 |
| Moose Mountain Power Company | Non-generating |
| Total horsepower | 131,970 |



Acceptance test of meters in the laboratory

# Polyphase Meter Practice

**By A. S. Albright**
*Superintendent of Meters*
*Detroit-Edison Company,*
*Detroit, Mich.*

THE large and increasing number of three-phase supply circuits for motors and devices of all sizes requires a corresponding increase in the number of polyphase watt-hour meters used by the electricity supply companies that furnish energy to them. In the earlier days of the industry several methods of metering three-phase energy were used, some of which were far from accurate. Fortunately, good practice has now become quite well standardized and only in rare instances are the earlier "approximate" schemes used.

The well-known rule that any circuit having "n" wires may be metered by the use of n-1 meter elements makes it possible to measure the energy in a three-phase, three-wire system by two single-phase elements. These two elements are ordinarily combined as the operating parts of a self-contained polyphase meter.

It is a generally accepted fact that all watt-hour meters should be tested at certain intervals and also that polyphase meters, because of their usually larger registration, deserve special consideration and attention. However, there appears to be considerable difference of opinion as to what method to use in the case of the polyphase meters. The "Handbook for Electrical Metermen," compiled by the meter committee of the National Electric Light Association, contains much valuable material on this subject, and stands in a unique position as a manual of commercial metering practice that may well serve as a guide to meter engineers.

The following outline of procedure is one that has been found workable in a large company and is submitted in the hope that it may be useful to those engineers who have not established a definite routine and that it may arouse interest and perhaps discussion among others. For simplicity only two-element, three-phase, three-wire meters, without current or potential transformers, will be considered.

## Laboratory Inspection and Testing

It is important that the meters should be selected and purchased to fit the service on which they are to be used. Modern meters are remarkably accurate and uniform, but they should not be expected to operate properly on circuits for which they are not designed. Voltage, current, frequency, etc., should be definitely known and the purchases made accordingly.

Upon unpacking, the meters should be examined for any possible damage in transit, and after numbers are assigned and records made, should be set up on the test board for closer inspection. Here all parts should be carefully scrutinized for any flaws such as imperfect jewel bearings, loose connections, improper insulation or alignment of coils, etc.

With both potential coils energized the two elements of the meter should be tested separately by means of a standard meter and adjusted if necessary on light (5 or 10 per cent) load, heavy (75 or 100 per cent) load, and inductive (75 or 100 per cent rated current) load. Runs of at least 40 seconds should be taken in order to minimize human errors. The inductive or "power factor" test is important, since polyphase meters usually operate with one or both elements at a low power factor. With a three-phase power factor of 86 per cent lag one element of the meter operates at 100 per cent and the other at 50 per cent lag, and therefore a difference of only 3 per cent between accuracy at 50 per cent and unity power factor on the slow element would result in a 1 per cent total error in the meter. Hence it is important that the inductive load accuracy be kept within close limits. It is customary to specify that the accuracy at 50 per cent power factor shall be within 2 per cent of correct. The inductive load test is sometimes made at zero power factor, but this is not advisable, as it then becomes difficult to distinguish between light and load friction and lagging errors.

The test for balance or equality between elements is also important for reasons similar to those given for the inductive tests. There are times when either element may carry all or a greater part of the load, and hence they should be in close agreement separately as well as when both are operating.

The limits of accuracy for the various test loads are quite well set down by the various local regulatory bodies and state commissions and by the United States Bureau of Standards in its Circular 56, and will not be discussed here.

The increasing use of demand meters operated by contact devices on the meter register has made necessary a closer inspection of registers so equipped. Also, where these devices are used, the light load accuracy of the meter should be carefully watched.

Most state commissions now require an "installation" test to be made on polyphase meters within a specified short period after they are put in service. This is important, and where not so required they should by all means be made a matter of regular routine in order to insure correct connections and initial accuracy. "Periodical" tests are now, as mentioned previously, standard practice, and are made at various intervals of from one month to two years, depending upon the size of the meter or upon local rulings. Special tests are also made from time to time to satisfy customers or for other reasons.

Several methods for verifying the accuracy of meters in service are in use, the selection of the one to be used depending to a large extent upon local conditions. The true purpose of the test should always be borne in mind. This purpose is twofold: (1) To determine the condition of the meter at the time of test and (2) to insure correct registration until the next inspection. Thus the test must show the accuracy of the meter as it is when customer's load is taking energy through it, whatever that load may be and whatever its power factor.

Ordinarily it is not feasible to test on the operating load, due to the impracticability of varying it at will. Therefore rheostats or loading transformers are used to give the desired currents. Some companies use a polyphase rotating standard and a polyphase testing load. This means special equipment, however, and is not always convenient.

### USING A SINGLE-PHASE ROTATING STANDARD

The simplest method is the use of a single-phase rotating standard, testing each element of the meter separately with both potential windings energized from the three-phase circuit. Under these conditions the percentages of the load at which the tests are made, as 10 per cent or 80 per cent, refer to the total watt rating of the meter. Care should be taken, however, that no test be made at a load greater than full current rating of one element. Thus, the 5 per cent load test on the meter would be made with 10 per cent of the rated current on the element under test, since the meter is then running at a speed corresponding to 5 per cent of its full load speed. Results of tests on the two elements of the meter should agree within 2 per cent as stated in the procedure for laboratory tests. This is important, since at loads at various power factors either element may carry all or none of the load under extreme conditions.

Adjustments for inaccuracy on heavy loads are readily made with the means provided. In case of light load inaccuracy it is advisable to make approximately the same amount of adjustment on both elements in order to maintain balanced conditions in the meter. In either case the meter should be carefully cleaned and all sources of undue friction removed before any adjustments are made.

An optional method of testing that may be employed where it is desired to cut down the time spent consists in connecting the potential coils of the meter in parallel across the same phase of the supply circuit and the current coils in series with each other and the rotating standards. In this case the percentage of load at which the test is made refers also to rated capacity of the meter.

It is important to note, however, that when this series test is adopted as a routine method, the meter should also at stated longer intervals be tested on its separate elements. This is necessary in order that any tendency toward unbalance may be detected.

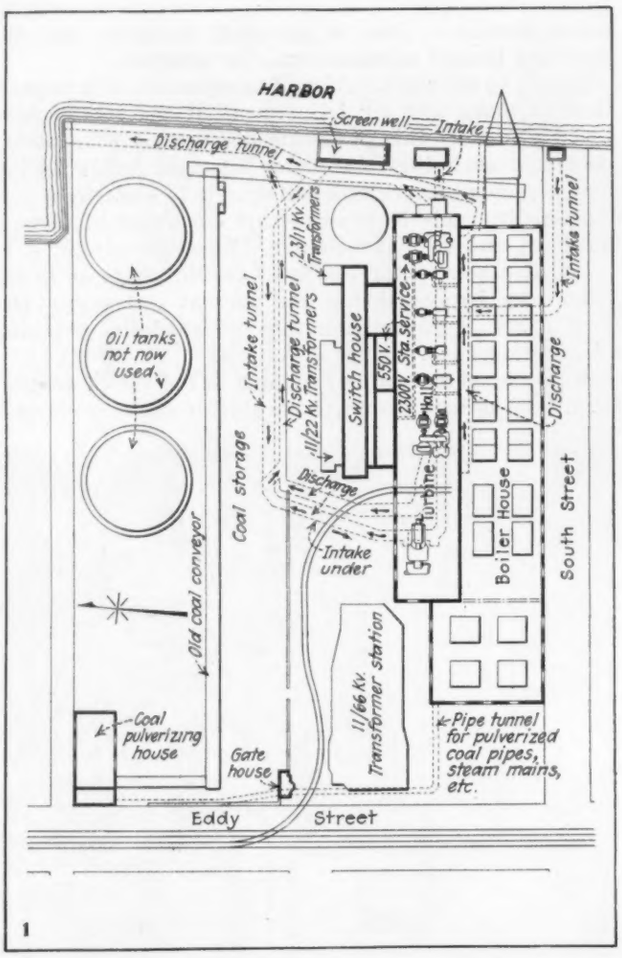
Owing to the construction of most meters it is impractical to make any lag adjustment at the service test, and fortunately this is seldom necessary. Present-day design is such that the meter normally holds its low power factor balance indefinitely. It is sometimes considered desirable to confirm this condition in service, however, and on a three-phase, three-wire circuit a 50 per cent power factor test is as readily made as in the laboratory by connecting the current coil under test to a different phase than that to which its potential coil is connected.

An optional method is available in the use of an artificial loading device, or a phase shifter where preferred.

SERVICE TESTING ON CUSTOMER'S PREMISES, USING SINGLE-PHASE STANDARD ON POLYPHASE METER

It is sometimes desired to know whether the power factor on which a meter is normally operating is leading or lagging. This may be determined as follows: If the load includes induction motors, we know that they draw low power factor lagging current when lightly loaded. Therefore if we check the power factor on the meter with a certain load through it and then throw on the line one or more lightly loaded inductive motors, a resulting lower power factor on the meter indicates that the power factor was lagging. Conversely, if a higher power factor results, the total was leading.

As stated earlier, the object of this article is not to describe the one and only right way to test a polyphase meter, but to outline an acceptable method or methods that may be adapted to local conditions. The main point to bear in mind is that the meters should be carefully inspected before installation and periodically tested afterward to insure that the initial accuracy is maintained.

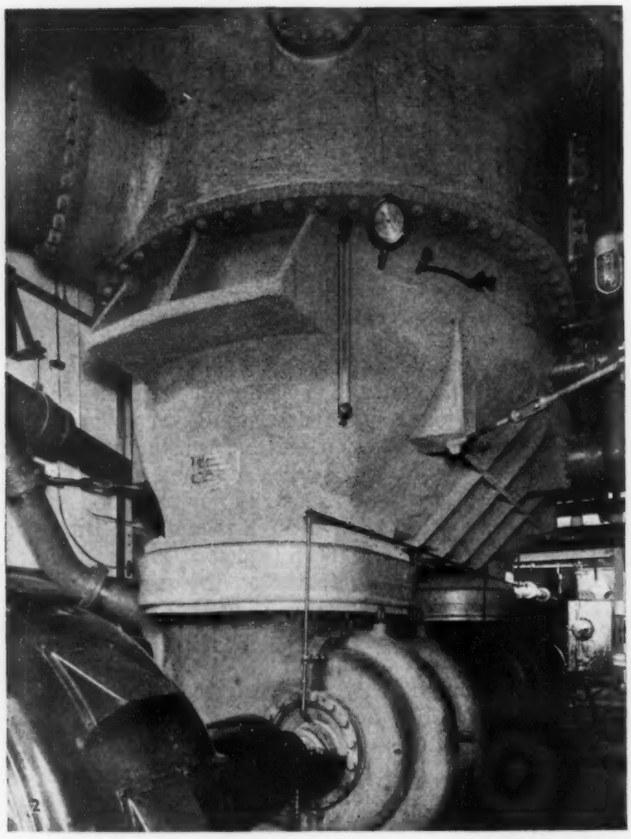


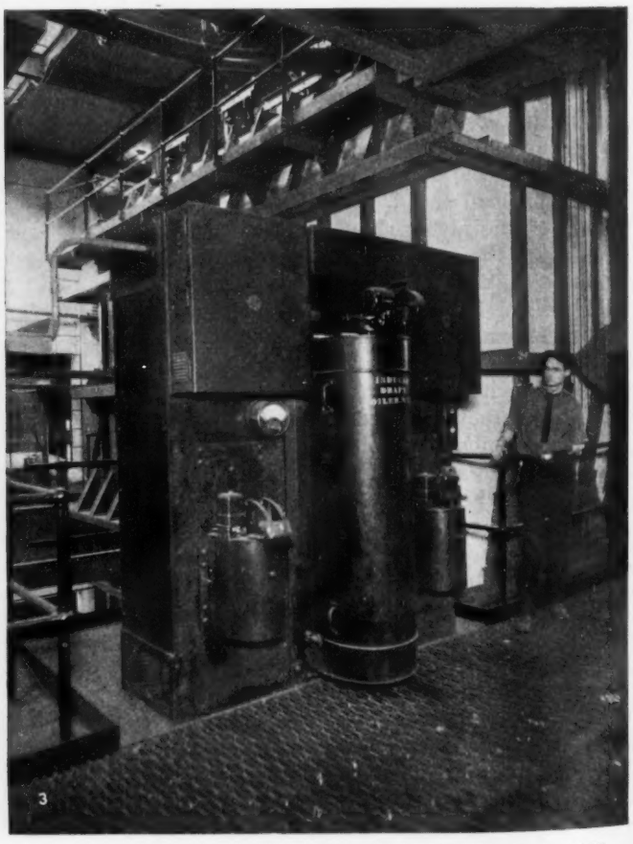

# Steam Plant Improvements Costing

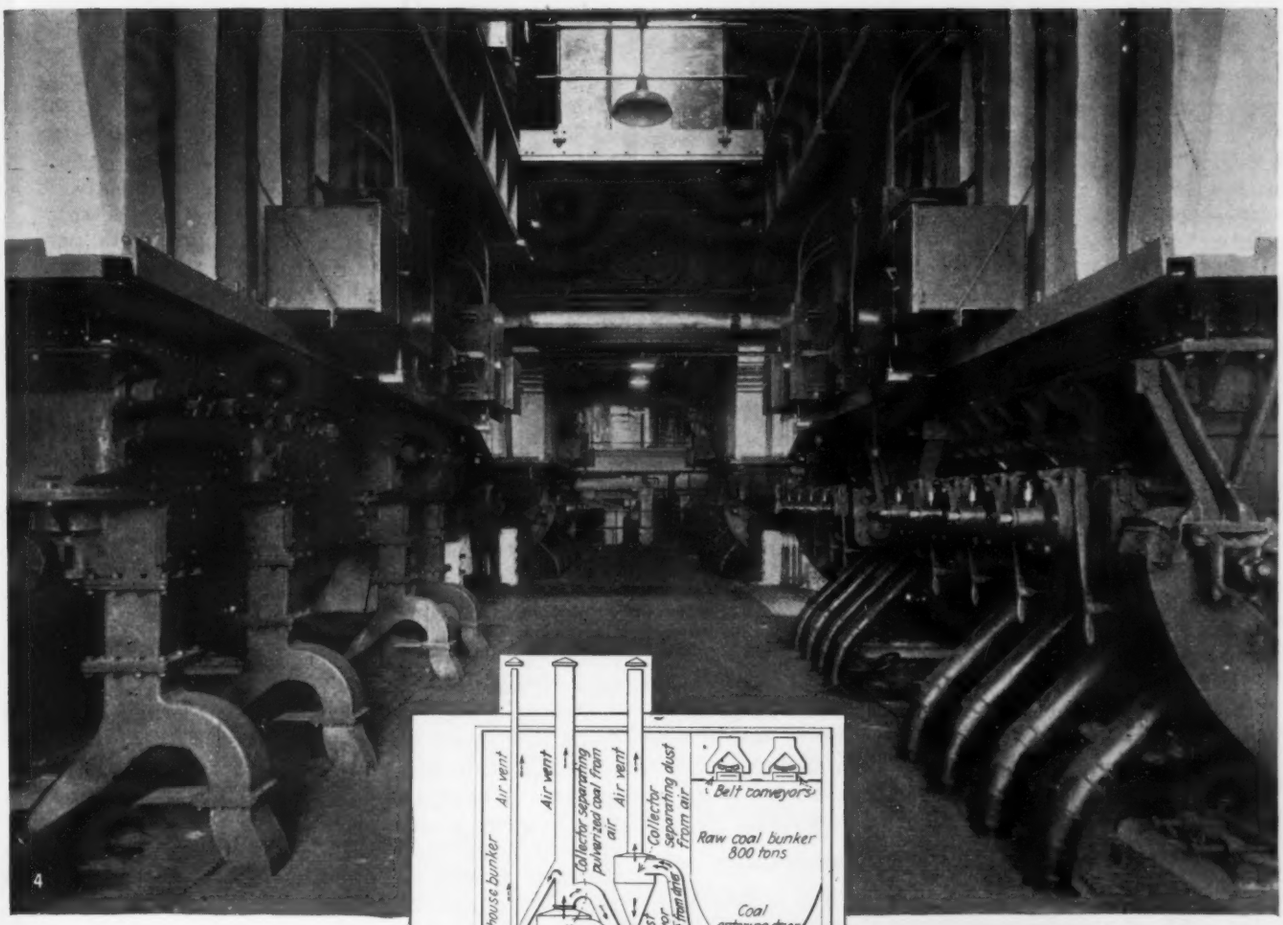
# $5,000,000

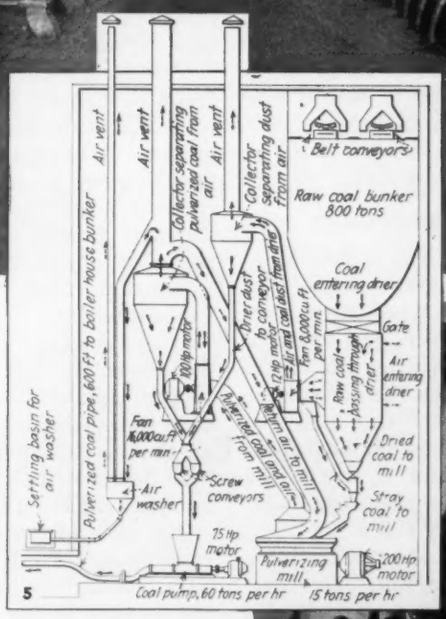
## Completed at Providence, R. I.

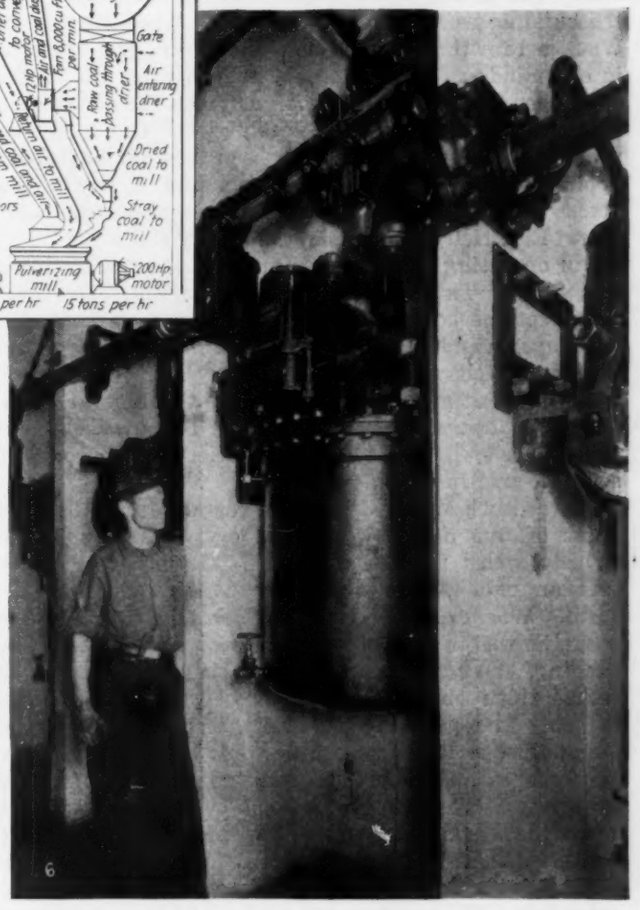
RECENTLY completed improvements at the South Street station of the Narragansett Electric Lighting Company, the second largest steam plant in New England, include a new boiler house, the addition of a 35,000-kw. turbo-generator, revision of the condensing water system, a new turbine hall, adoption of pulverized coal, improved switching facilities for station service and the construction of an 11/66-kv. outdoor transformer substation. The plant now has a rating of 150,000 kw. and for years has been one of the chief steam relays interconnected with the New England Power Company system. More than 700 contracts were let in the latest improvement work, which was handled by the engineering firm of Jenks & Ballou, Providence, R. I.







## Boiler Room Outline of Coal Processing and Circuit Breaker Mounting

No. 1. Plan showing major improvements at South Street station. "Short-circuiting" of the condensing water supply and discharge has been eliminated by wide separation of intake and outlet connections.

No. 2. Corrosive harbor water forced use of jet condensation. The single-jet condenser shown is believed to be the largest of its kind ever built; it is served by two centrifugal double rotor removal pumps, each of 18,000 gal. per minute capacity, and has a water-sealed double vacuum breaker. Its interior is lead lined and the injection valves are provided with remote motor control.

No. 3. 2,300-volt inclosed control panel for induced draft.

No. 4. Boiler house coal-feeding and water-tending level.

No. 5. Diagrammatic arrangement of pulverizing house.

No. 6. Pole unit of main circuit breaker; rupturing capacity, 1,500,000 kva.

*Reminiscences of*

# A Rural Utility's Problems

*by a Participant*

"THE old order changeth, yielding place to new." The accompanying philosophical account of one small company's attempts to bolster feeble revenues, the limitations imposed upon it by its isolation, the value of its personal contacts and its final absorption was written by the operator of the property, who chooses to remain unidentified. Reminiscent allusion is made particularly to the cordial public relations which existed in this company and are no less valuable to the large organizations which are fast absorbing small plants like the one discussed.

ABOUT 25 years ago an electric light company was organized in a small community in the eastern part of the United States. In common with all villages of its size at that period its streets were lit, not illuminated, with coal oil lanterns perched on the top of cedar posts. It was not unusual for this support to serve double duty as a hitching post and street-light holder. The only light in the homes was the kerosene lamp. The founder of the local lighting company was one of the young men of the village, who had been a watch engineer in a small steam station in an adjacent county. By self-denial he had managed to save a few thousand dollars. Associated with his saving proclivities was a courage that urged him to try his hand at the promotion of an electric lighting company.

### Limited Force and Feeble Revenues

The night we started up the plant was a gala occasion. All of the townspeople who could squeeze into the building were there to see the first wheel turn over. We hoped for the best, although there were grave doubts in our minds as to what would happen when the steam was turned on. Luck was with us when the street arcs shone forth with their first feeble glow. Our load was practically nil—folks had not been sold on household appliances yet. The street lights and a few wired homes constituted our entire revenue-producing business. Electricity was still in the luxury class.

Our operating force was as limited as the new business was scarce. Three men were on the payroll. The boss' wife kept the books, and she was not overworked. He was superintendent at a salary that the laborers would not accept today. There was no day load. The plant was started at sunset and shut down at midnight. Our theory of operation was that none of our customers should need any light after 12 o'clock. A moonlight schedule was in effect.

It was nip and tuck during the early years. Although a lot of our duties were drudgery, there was some comedy mixed in with the work. Our night operator was an oldish, near-sighted chap—a product of the farm. Whenever he wished to look across the engine room, he was in the habit of removing his glasses. One evening, during a moment of absentmindedness, he placed them on the knife blades of the exciter field switch. There was a flash and the station shut down. On another occasion something went wrong in the plant that caused a trip-out. He was unable to get started or discover why the lights went out. This happened when the system was alive from night until morning. Since we were too small to afford the luxury of a telephone, he was not able to get in touch with the superintendent. No one else was aware of his predicament, as the knockout took place in the early morning. He gave it up, banked the fire, locked up the place and left the following tacked on the door: Plant shut down, cause unknown; gone home.

The struggling company somehow or other cut its teeth and slowly got onto its feet. In the course of time the business grew until larger quarters were required. A more commodious building was erected at a new location, where it was possible to obtain water for condensing purposes. But we had little money left with which to purchase equipment. Our only hope was the second-hand dealers. Hence our second start was made in better surroundings, but with the same kind of obsolete equipment.

It did not take us long to realize that the home town was too small. All possible sources of revenue had been tapped, and still we had not grown much. Our only hope was to extend out into the country and reach some of the neighboring villages. We were still suffering with dollar anemia. Some of the transmission lines put up appeared to be troubled with the rickets.

The style of lines did not tax our ingenuity. Getting franchises did. Not many people wished to have our wires strung in front of their property. Electricity, as the servant in the home, was far away. After a long and tiresome process of negotiation with the various village boards and property owners we were at last permitted to use the side of the road for our poles. The lines were built on faith; very little paying business was in sight. Borrowed money and the sale of small blocks of preferred stock supplied the funds that put the wires into the air. We prayed that future earnings would keep them there.

### A New Era Dawns

A great day came when the plant could not turn out another kilowatt-hour. A new era had dawned. We thought we had arrived. To take care of the increased load additional equipment was imperative. Our superintendent, who was the controlling stockholder, was strong for expansion. So were we all. Lack of cash and fear of bank credit cooled our ardor. The problem was at last solved by another utility building a tie line into our station. This connection kept us from spending money we did not have, but it destroyed our former simple methods of operation. Demand charges began to trouble us. System

peak loads of short duration began to mean something. We learned that they were costly. To minimize their influence on the operating costs the switchboard attendant had to watch his machine load constantly. A sudden demand on our neighbor's line knocked all of the profit off from a good many of our own kilowatt-hours. Another bad habit of this line was tripping out when we were chock-a-block with load. Of course, our system went dead and stayed so until the operator could get his own unit back on the line. Having a Corliss engine-driven generator with the old-time jet condenser, it was a slow job. Some of our customers complained of the poor service, and with good reason.

In the course of time a brand new unit was purchased —one fresh from the factory. Most of us had to learn all over again how to operate. It seemed strange to have a machine in the station that did not require a lot of tinkering to keep it running. Whereas with the old apparatus our best performance had been about 4 lb. of coal per kilowatt-hour, now we could do it with a shade over 2 lb. To be fair, I must give the new boilers some credit for this marked improvement. Three water-tube boilers had replaced four worn-out fire-tube boilers. Last February the unit was six years old—an infant yet compared with the life of the plant. It has given practically no trouble and more than earned its keep in the past two years. During this time it has been fully loaded. It is 3,750 kva., small as units are rated today.

### The Rural Problem

Although business has grown, the load is small when compared with the average metropolitan system. Our territory has always been rural. Rapid growth is out of the question among the farms and villages that we serve. There are no large consumers and the future is not likely to provide any. There is not a town on our lines with a population of more than 5,000. The burning question in this kind of territory is how to make a profit on customers that are so scattered. This problem has not been solved to our satisfaction yet, nor is it ever likely to be. To make the rural lines pay necessitates a minimum monthly meter charge that on the face of it appears exorbitant.

As the other extreme there is the seasonal consumer. Like the birds, they are with us during the summer, and leave for the city in the fall. They are a headache-producing problem. Candidly, we admit that we do not know what to do with them. The kilowatt-hour charge to them is high compared with the urban rates. Some of these customers complain and a few of them blame this condition on the fact that we enjoy a monopoly. The fact that our rates are considered equitable by the commission does not impress them. We have nearly given up trying to explain why our limited business cannot exist on the same rates that are charged in the city. Even the Ford example of mass production applied to kilowatts rarely closes the argument that we charge too much. They fail to realize that the few summer months during which their meters produce a little revenue does not lower our unit costs to any appreciable extent, and that money which costs the power company 7 per cent is tied up in their lines that are producing no revenue nine months in the year. Unfortunately for us, fixed charges do not cease when the summer home is closed for the winter.

Then there is the case of the isolated farm. The owner desires service and is willing to pay for it—within reason. When he finds what it costs to connect one place, he firmly believes we are charging him too much. If we cannot come to a working agreement, he may take his case to the commission and ask it to order our company to build a line to his home. It is very hard to explain to him that a loss on his business must be made up on some other; that if his service is provided at less than cost, some other group of consumers must make up the deficit. The commission has tried to be fair when such cases have arisen, and so far we have not had to construct such lines unless the land owner paid the cost of the line.

### Personal Contacts Were Stimulating

With all of the difficulties, we have had some fun as we passed along. The personal contacts have been very stimulating. It has been pleasant and interesting to watch the growth of what is now a small corporation. Before coming here the writer's experience had been with the larger management. The difference has been very noticeable. The large corporation, as a rule, finds leadership difficult because the personal touch is lacking. Most of us, as individuals, like to see the wheels go round. This is hardly possible for the small cog in the large corporate machine. The large business is not to blame, for how can management of large affairs know all of the details?

With us the spirit of adventure is not dead. We are so small that none of us has lost his individuality. Each, being a visible part of the whole, has had the feeling engendered in his mind that he counts for something in the corporation's scheme of things. This is the great advantage the small business has over the large business. The speed with which decisions can be obtained from the management keeps interest from dying out.

Today we are controlled by our customers. They own most of the stock and bonds that have been issued. This has kept us away from the banks and bond houses. Maybe we are lucky. Customer ownership is said to be a good thing for all concerned. We are proud of our dividend record. Not one has been passed since the formation of the company. We realize that sales of securities to our friends means a slow growth of capital. We have always been hampered for lack of funds. We should like to expand more rapidly, but it is not possible. No doubt this is a good thing, for it has kept us from biting off more than we could swallow.

One thing of great importance we have missed, and that is the opportunity to experiment. Utility growth is based on research. Because of our limited resources we have had to depend on our stronger associates for information pertaining to new developments in the electric utility field. We wish it were possible to express our appreciation for this help to all who have contributed to it. To the N.E.L.A. in particular we are indebted for the valuable information supplied by its bulletins. We never attend the conventions, but we have found the association's reports the next best thing. Then the open-door policy of the larger utilities deserves commendation. Their laboratories have kept us little fellows out of a lot of trouble. The writer ungrudgingly gives them all of the credit to which they are entitled.

### Bread Cast on Water

There are some interesting sidelights connected with our financing. Let me close with two. The sale of preferred stock provides us with capital today. But some years ago we were not so well known in our local-

ity. Our stock was not easy to sell. Any that we did sell had to be with the implied understanding that we would buy it back if the purchaser should wish to get rid of it. We do not broadcast this fact today, but any stockholder who desires to sell can always get what he paid for the securities at our office. To illustrate this policy more specifically and to the point let me cite the following case:

A farmer came into the office one morning with a twenty-share stock certificate for which he wanted cash. No questions were asked; he was given the company's check for $2,000 plus accrued dividends. He looked his surprise, but said nothing. The incident had been forgotten when one day an elderly gentleman stepped into the office. He introduced himself to the office manager and said he wanted to buy a few shares of stock. Questioned as to how much money he wished to invest, he replied that he thought $5,000 would be a good starter. This was so unusual, coming from a stranger, that the manager was curious to know why he had picked so small a company for one of his investments. As a rule we sold stock only to our acquaintances and then rarely in 50-share lots. His explanation was something like this: It appeared that his son had at one time been a stockholder. He had been able to sell his holdings to the company for cash when he needed some ready money. With the sum realized from the sale of his stock he paid his father for some land. Naturally he told his father where he raised the price of the property, and the older man had not forgotten it. He reasoned that any company that stood back of its stock in this manner would be a good place for some of his funds that were earning only bank interest.

So by losing a twenty-share investor the utility gained a 50-share investor.

### A VALUABLE LESSON

The other incident does not end so pleasantly, but perhaps it teaches a more valuable lesson. We were making a drive for more customer stockholders to get funds for additional equipment. Our meter readers were the salesmen and some of them were having phenomenal success. Coming in after one especially successful trip, one of them related the following experience: He had tried his best to interest a local farmer, but could get nowhere with him. No amount of sales talk could induce him to buy. He emphatically stated that he wanted none of the stock. Knowing that the man could buy, if he wished, our meter reader pressed him for the reason behind his refusal. At last he gave an explanation: "Not long ago a line gang was in front of my place making a bluff at digging post holes. It looked to me as if the gang was too large for the size of the job. Anyway, some of them were working and the others were behind my barn shooting craps. Your stockholders pay for this kind of thing, and it depreciates the value of all of the shares," was his parting shot. This was a shock to those of us who heard it. It brought home to the writer how a public utility employee looks to the outsider. It also showed how any of us by a little carelessness can injure the company's reputation in the community.

Our little system has come to the fork in the road. It will not be long before we are absorbed by a larger system. Will this mean the end of the personal element that has been so helpful? We all know that we cannot stop progress and that the present-day consolidations are part of it. Nevertheless we choke a sigh.

# Location of Radio Interference

## Procedure Followed in Tracing Source of Trouble—Equipment Used—Most Frequent Causes of Trouble

BY B. E. ELLSWORTH
Engineer Nebraska Gas & Electric Company

THREE reasons exist why operating companies should be interested in minimizing radio interference: First, most types of interference, even if they do not originate on the utility company's system, will travel along the utility lines. The public knows this fact and in order to keep its good will these troubles must be found and remedied. Many companies capitalize on this work by having a salesman follow up each successful clearance of trouble and through the good will thus secured sell their goods. Second, the lighting load is considerably increased if the radio set is functioning properly, as later hours are "kept" by the listener, with a corresponding larger amount of power used for lights. Third, since A and B battery eliminators have made their appearance, the load caused by these radio accessories is not to be overlooked.

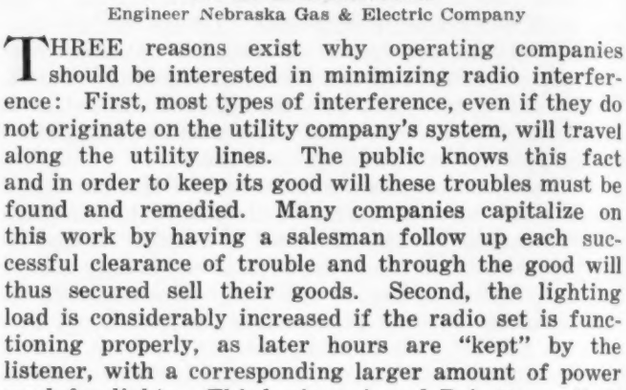



DIAGRAM OF TEST SET FOR LOCATING INTERFERENCE

From records obtained during the past year or two by the Nebraska Gas & Electric Company it has been found that only a part of the reported trouble cases were caused or carried by the company's lines. The rest of the trouble was found to be in the receiving set itself, interfering broadcasting stations or other sets in the neighborhood.

The equipment used by this company in hunting for the source of radio trouble consists of two sets, a Radiola 26, a portable superheterodyne and a home-made three-tube portable set. An exploring coil can be used with either set. An experienced man can usually tell by the sound of the interference whether it is an electric vibrator, a brush-type motor or an arc of some kind. The first test to be made is to open the house entrance switch and see whether the sound ceases. If the interference stops, the trouble originates outside the house and comes in over the house-service wires. If the noise is only partly stopped, it is known that the interference is coming in not only over the service wires but also through the aërial. If the noise is not affected at all, the trouble is not coming in over the service wires. Obviously, the preceding test is not possible where a B eliminator is used unless a B battery is substituted.

If the source of trouble is found to be inside the

house, a thorough search should be made for defective lamp sockets, grounds in the house wiring and arcing contacts or connections in circuits or apparatus attached thereto. The neutral ground at the transformer may be broken, thus making possible a small arc to ground in the house wiring. This arc may continue for a long time without causing a fire or blowing a fuse. If the trouble does not exist inside the house, it should easily be heard by the use of a test set placed outdoors under the secondary wires.

Location of trouble by using the directional effect of the loop aërial is not successful in a network of wires. The aërial will always point toward the wires instead of toward the source of trouble. The place of loudest volume should be looked for, and care must be taken not to follow false indications, as the volume is always greater near line crossings and at the end of a line.

Usually a given secondary is very limited in extent and the quickest way to find the trouble is to station one man at the set where the interference is heard the loudest and have a helper pull every entrance switch on the particular secondary in turn, until the one is pulled which stops the trouble. Where there are several secondaries along the same pole line, the one causing the trouble can be located by pulling the transformer fuses in turn. These methods are not feasible unless the co-operation of customers whose service will be interrupted is secured.

### Tracing Interference Using Volume Test

Where secondaries are interconnected and no means is provided for sectionalizing, then the only available method of tracing the source of interference is by volume test. Interconnected secondaries sometimes permit interference to be apparent over a wide area. In many cases noises on a secondary system are amplified in the set when an eliminator is installed in place of batteries. The directional effect of the loop may be used to advantage at times. For this work the set must be located some distance from the wires that would otherwise affect the readings. The directional effect is also very pronounced at close range and may be used in finding a faulty primary back of a switchboard.

If the trouble is found to be in the primary feeders, the chances are that it is an arc of some kind and the trouble will be widely distributed. Trouble on one primary may be distributed to others at the switchboard or by parallel circuits on the same pole line which may have a capacity coupling. The trouble may be heard several miles from the source. Where sectionalizing is possible, the primary giving the trouble can easily be located. Where service interruption is not possible, the small set, with or without the exploring coil, will indicate the faulty primary.

In some cases the trouble will be so remote from the switchboard that a good test cannot be made at this place. In this case the primaries should be followed and a search made for the location giving the loudest signal. In some cases the wave length of the disturbance will decrease as the source is approached, due to less length of wire in the radiating system between source and set. This is not always a true guide as there may be several very pronounced wave lengths from the same arc.

In general, 2,300-volt feeder grounds cause the most trouble, as 6,600-volt lines and higher soon burn themselves free. Grounded Y systems produce less interference than delta. The following list of causes of radio interference is as complete as is available at this time:

*A. On Secondary Lines:*

1. Faulty lamp socket.
2. Faulty switch.
3. Lamp or fuse loose.
4. Light ground in house wiring.
5. Faulty slip ring or commutator motor.
6. Thermostats.
7. Faulty bell-ringing transformer.
8. Vibrator battery chargers.
9. Electric bells and buzzers.
10. Violet ray equipment.
11. Amateur experimenters.
12. Elevators.
13. X-ray machines.
14. Faulty ground on distribution secondary neutral.
15. Telephone-ringing equipment.
16. Old tube in mercury arc rectifier.
17. Sign flashers.
18. Auto or engine ignition systems.
19. Smoke eliminators.
20. Ozonators.

*B. Set Noises:*

1. Regenerative receiving sets.
2. Broadcasting station squeal or generator hum.
3. Old B batteries.
4. Defective tube.
5. Neutrodyne not balanced.
6. Loose ground or aërial wire.
7. Static.

*C. Power Company's Equipment:*

1. Trees rubbing on primaries or street light wires.
2. Loose connections on street hoods.
3. Loose transformer fuses.
4. Defective voltage regulators.
5. Arc from primary to guy wire.
6. Broken insulators.
7. Arc from primary to wet pole or damp wall in plant.
8. Defective lightning arresters.
9. Arcing between wires.
10. Defective street car motors and starters.
11. Broken track bonds.
12. Defective arc light circuits.
13. Broken transformer bushing.
14. Open and arcing secondary of current transformer.
15. Ground loose on metal frames (produces static discharge).
16. Oil circuit breaker contact poor.
17. Leaking through the back of primary cutouts and fuses.
18. Defective pothead.
19. Cable breakdown.
20. Loose disconnect switch.

The remedy, after the cause has been found, is sometimes easy and sometimes difficult. Where the trouble is caused by faulty equipment, the remedy is obvious. On equipment of 500-volt rating or lower a wave trap consisting of a shunt condenser or a shunt condenser and series chokes can be used to good advantage. Choke coils are usually made by winding about 400 turns of wire on an iron core; some use air core chokes. The condensers range from 1 to 3 microfarads. Experiment must determine the size of the units for every wave trap, their size being increased until the disturbance is no longer noticeable.

The principal advantage of the small three-tube set used by this company is that it is light and easily carried. It will not pick up very many broadcasting stations, and this is an advantage. Its small size permits it to be brought into close proximity to switchboard feeders, lightning arrester and neutral grounds. Phones are used that exclude outside noises. Care must be taken not to touch a live line with the set or exploring coils while standing on a damp floor. The exploring coil on the end of a long pole will make possible tests that would otherwise be out of reach. The diagram of the small set is here shown and is self-explanatory. A portable Crosley cabinet has been used by this company to house the set. The loop is made of 25 to 50 turns of fixture wire mounted on an "X" frame in the back of the cabinet. The set should be adjusted so the oscillations can be controlled by the Rembler coupler.

# Letters from Our Readers

### Supply and Demand in the Motor Industry

*To the Editor of the* ELECTRICAL WORLD:

The writer, who has been connected with the electrical industry for 29 years, sees some points in a different light from that of the article in the Feb. 12 issue of the ELECTRICAL WORLD headed "What's Wrong with the Motor Industry?"

The present condition has been brought about by natural means. After financing, the problems were first engineering, then production. When the industry had reached the production stage, and before definite commercial policies had been developed, the war came on. At about the same time the fundamental patents expired, allowing any one to enter the field. An unusually vigorous war demand at this particular time stimulated production, causing old manufacturers to expand and new companies to start. New plants were built by men withdrawing from the old-established concerns, and frequently with considerable ill will. This left the industry unorganized when the war boom was over, with a large producing capacity and no established commercial policies to control or direct the output. The theory seemed to prevail that if sufficient sales effort and price inducement were put forth, the demand was inexhaustible, and if the output were large enough, any price would be profitable. This vicious circle ignored the old law of supply and demand and encouraged further overproduction.

While, as you state, the motor business may be largely in the hands of engineers, it is a fact that the sales and commercial policies have almost altogether been directed by sales executives, or the "sales engineer," as the term has developed, and not by the engineer who is responsible for the designing and production. This is not the seat of the trouble.

You also state that sales managers are poorly paid and that poor sales managers are most expensive. However, this is an effect rather than a cause. When an executive position does not pay well, it generally means that the holder is not getting results; consequently it is not because sales executives are not well paid that the condition exists, but that the sales executives have brought on a condition that has eliminated profit, or at least have not been able to prevent it.

You say further that the bankers who are watching the situation assert that if those who are in power cannot make a success, they should step aside and let real merchants run the business. This has been one of the difficulties; no one is in power and there has been too much merchandising. The banker probably has in mind unified control of the industry, by which supply and demand could be balanced. There are now plenty of men in the industry who, if given the unified control, could put the business on a sound basis. The merchandiser or banker has been no more successful than the engineer under present conditions. The problem is how to bring about unity of thought and action within the industry, so that the supply and demand may be balanced.

The motor business is a combined financial, engineering and commercial problem. Success will not be attained by any one of them alone dominating. Concerns controlled by bankers or merchandisers are no more successful than those dominated by engineers. The most successful ones are those who are not dominated by any one factor but are operating under a harmonious democracy of all. The one and only trouble seems to be in ignoring the old law of supply and demand. Production is out of balance with demand. It is hard to say who caused it. Conditions not foreseen have been a large factor.

And it is as hard to say who will correct it. No one individually can. It will probably work out in the end, largely owing to conditions not now apparent. Increasing prices arbitrarily is not the solution. Under present conditions this might further stimulate overproduction, so that the reaction would make the situation worse.

Supply and demand will have to be balanced; then prices and practices will gradually right themselves. Unity within the industry by consolidation, or brought about by better understanding between the different members and the curtailment of expansion until the demand justifies it, seems to be the outstanding need.

Advance Electric Company,
St. Louis, Mo. EDWARD BRETCH.

### Standardization and the A. I. E. E.

*To the Editor of the* ELECTRICAL WORLD:

I have read with that interest that always attaches to the editorial comments of the ELECTRICAL WORLD your article of March 26 under the caption "Order and Authority Needed in Standardization" and want you to know that, as usual, I find myself most sympathetic with the wise judgment of the editor. I am not so sure, however, that the ELECTRICAL WORLD properly appraises just what the American Institute of Electrical Engineers was endeavoring to do in its recent proposals in regard to the standardization practice. Possibly the Institute was clumsy in its expressions.

Some of us members of the institute engaged primarily in commercial and industrial undertakings are persuaded that there is not, and cannot be, any authority for standards other than acceptance by mutual consent. Even governmental authority, assuming such to exist, could not assure practical working acceptance of standards except as standards commended themselves to all those engaged in the process of design, production and utilization. In the hope of finding some means of bringing together the various interests and of affording a clearing house in which those interests might hammer out a mutually acceptable program, the Institute has suggested that the professional bodies generally offer an administrative agency ideally suited to rendering a service, and the Institute has—its constitution not explicitly providing, but none the less not prohibiting—undertaken to include in its standards committee official, corporate and instructed delegations.

The Institute has not arrogated to itself any final authority, but has offered a service and tentatively extended recognition to two great commercial interests. I can't quite bring myself to feel that this is a backward step. If this generously intended position of the Institute is not acceptable to the industry, the Institute's judgment was wrong and some other and wiser plan must be tried. Personally, I feel that the Institute's program can be made to work, but it surely can't be made to work unless it is viewed in the spirit in which it has been proposed.

In passing I rise to inquire, why the differentiation

between technical and commercial matters? About 99 per cent of my own work is commercial, social and administrative and about 1 per cent technical. I am sure that this is true of most of the members of our professional engineering societies. Certainly, membership is catholic enough to include all sorts and conditions of engineers and near-engineers, and assuredly, if our engineering societies must confine themselves to technical matters, they must become merely scientific bodies and not such very scientific bodies at that. It seems to me that it is exactly the social and economic aspects of our work, including production and utilization of devices, which differentiate engineering from the physical sciences. Without this differentiation the engineering societies have no real right to exist. It may be because of this understanding of what our profession actually is that I seem to see not only in the American Institute but in the other great professional bodies suitable service organizations for bringing together the desires of all parties, welding them into a harmonious whole which shall be submitted to the American Engineering Standards Committee, frankly and spontaneously recognized as the sole authority for American standards.

Brooklyn Edison Company, Brooklyn, N. Y. JOHN C. PARKER. Vice-president.

### Supports Objection to Comparison of Meters

*To the Editor of the* ELECTRICAL WORLD:

I am glad to see in your issue of Feb. 5 that Herbert Nehls has written in protest against the article which appeared in your issue of Jan. 8 entitled "Foreign and Domestic Meters Compared." The whole tone of the article is calculated to show that foreign-made meters are so inferior that they are not worthy of serious consideration. This statement is not only contrary to the facts but is contrary to the figures of the tests as shown in the report itself.

The following paragraph appears in italic type in the report: "The committee on metering and service methods has not found any meter of European manufacture that performs as well as the American product and that can be bought f.o.b. any point in the United States for appreciably less than the domestic product."

The ambiguity of this paragraph is characteristic of the report generally. Careful reading of it discloses the following information: That European meters of a quality equal to American meters are much more expensive and that those meters which are available at a price equal to the American manufacturers' price are not good enough to use. The paragraph is so worded, however, as to indicate that the committee has not been able to find a European meter as good as the American ones.

The plain facts are that European meters are available quite equal to those of domestic production, but owing to the tariff of 45 per cent, which is based upon the value of the meters in the country of origin, they are not available to the American user at an economical price.

It would be misleading to your readers to assume that this condition applies in the rest of the world, where American meters are sold in competition with those of Europe in a ratio preponderately in favor of European meters. There is no doubt that American-made meters have attained a very high standard of excellence, but it is equally true that European meters have of necessity attained a similar standard, and in reality the whole report could have been condensed into the following sentence: "European meters of a class equal to American meters are not available to American users because of their landed cost being so much higher than that of the domestic product."

Ferranti, Ltd., Hollinwood, Lancashire, England. R. H. SCHOFIELD, Sales Manager.

### Street-Lighting Control in Seattle

*To the Editor of the* ELECTRICAL WORLD:

The arrangement shown in Fig. 1, of the article* on the "New Street Lighting of Seattle," by C. Maynard Turner, is unworkable inasmuch as the lamps are connected alternately across either of the outer wires of the Edison three-wire, 120/240-volt mains and the control wire. When the relay switch disconnects the control wire from the neutral the lamps would remain burning since the two groups are in series across the 240-volt outer wires.

The proposed scheme does not permit advantage being taken of balancing the street lamps on both sides of individual sections of the three-wire system, unless a second control wire is erected and a double-pole relay used instead of a single-pole one. In the latter case it would be a better arrangement to connect the two control wires through the double-pole relay to the two outer wires and use the neutral as common return for all lights. This would leave all street lamps and fittings connected to the grounded neutral when not in use.

As the street-lighting load, however, forms a very small percentage of the demand generally, even in residential districts where the lighting load is usually very thin, I would not consider the placing of all street lamps on one side of the three-wire system on individual sections objectionable. By placing them on opposite sides of alternate sections a balance could be obtained on the system as a whole without resorting to a second control wire, which would add considerably to the cost of the scheme.

Jamaica Public Service Co., Ltd., Kingston, Jamaica, British West Indies. HENRY A. CAMPBELL, Electrical Engineer.

*To the Editor of the* ELECTRICAL WORLD:

The article on Seattle's new street lighting in your issue for Feb. 26 shows lamps connected two in series across the outside wires of the three-wire, 120/240-volt bus. Lamps so connected will burn regardless of whether the relays are on or off. When the relay is off the well-known condition exists of a three-wire system with the neutral fuse blown, in which the lamps on the more lightly loaded side will tend to burn out. In practice we connect all lamps on one control wire to the same side of the bus and balance the bus by alternating the groups of lamps rather than by balancing each group. There should be a note correcting this diagram, for we are having fine success with the multiple system in Seattle. During the stormy weather of the past few months the section of the city provided with multiple lamps had a considerably better record of continuity of service on the street lamps than the remainder of the city, which has series street circuits.

The multiple system described by Mr. Turner is the outcome of a study covering more than five years by our department, in which Mr. Turner participated and which he has ably presented with the exception of the error in his circuit as noted.

Lighting Department, Seattle, Wash. J. D. ROSS, Superintendent of Lighting.

*ELECTRICAL WORLD for Feb. 26, 1927, page 443.

# Central Station and Industrial Practice

## New Meter Board Facilitates Tests

By E. A. Corum
Meter Superintendent Memphis Power & Light Company, Memphis, Tenn.

A DEMAND-METER test board that permits conducting time and life tests on almost any kind of integrating, recording meter or instrument having either spring or electric drive has been designed by the meter department of the Memphis Power & Light Company.

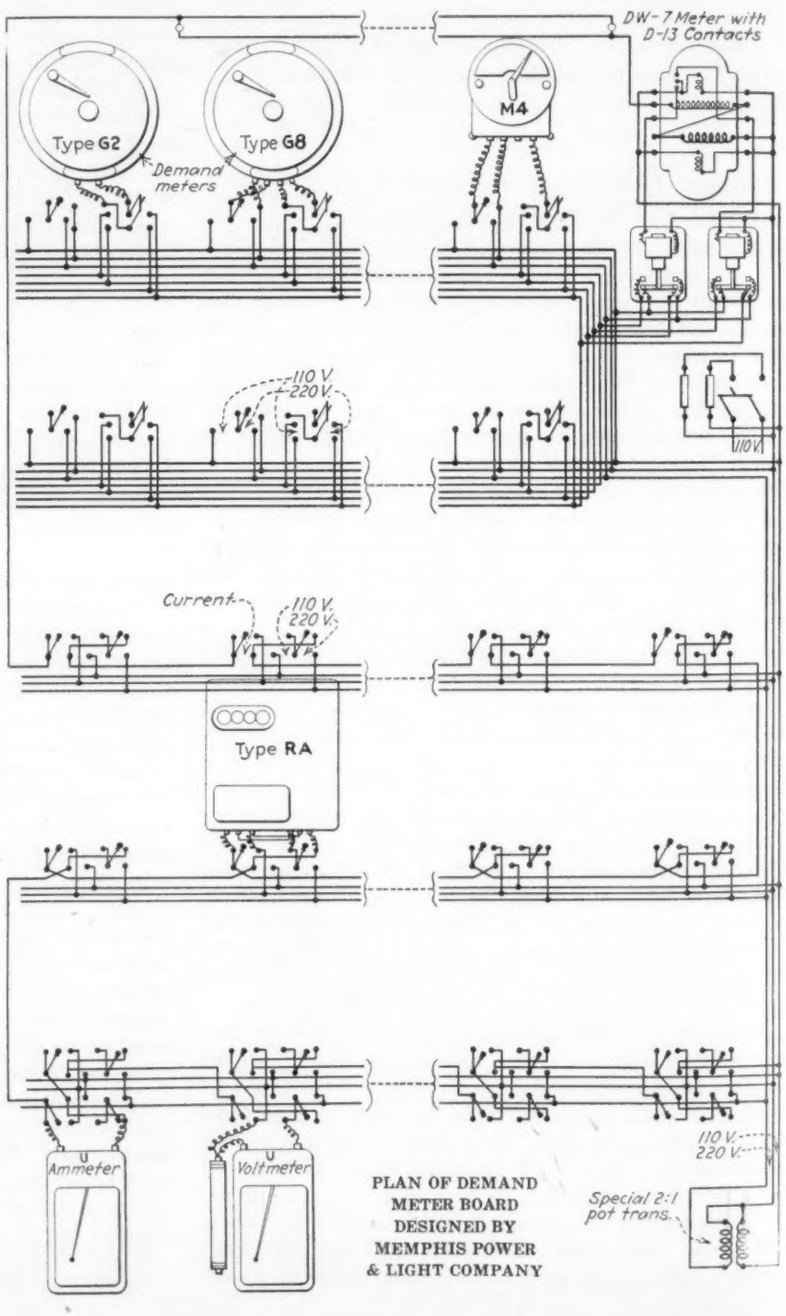
The two upper rows of terminals on the board are used primarily for demand meters controlled with type D-13 contacts, but may also be used for voltmeters. The contacts are installed on a 5-amp., DW-7 General Electric watt-hour meter, the meter being loaded with five 100-watt lamps, which answer the twofold purpose of illuminating the board and acting as a loading unit.

When the watt-hour meter is energized from the house circuit, the D-13 contacts alternately close and open the 110-volt circuit through two specially constructed double contact-making relays, which in turn make and break two circuits, one of 110 volts and the other 220 volts. The latter potential is obtained by means of a 2:1 ratio transformer, which supplies voltage only and which enables the tester to connect as many as 26 meters in parallel. By means of double-pole, double-throw switches mounted in the two top rows of the test board 110 volts or 220 volts can be supplied to the ratcheting coils such as are used in the General Electric types G and M meters.

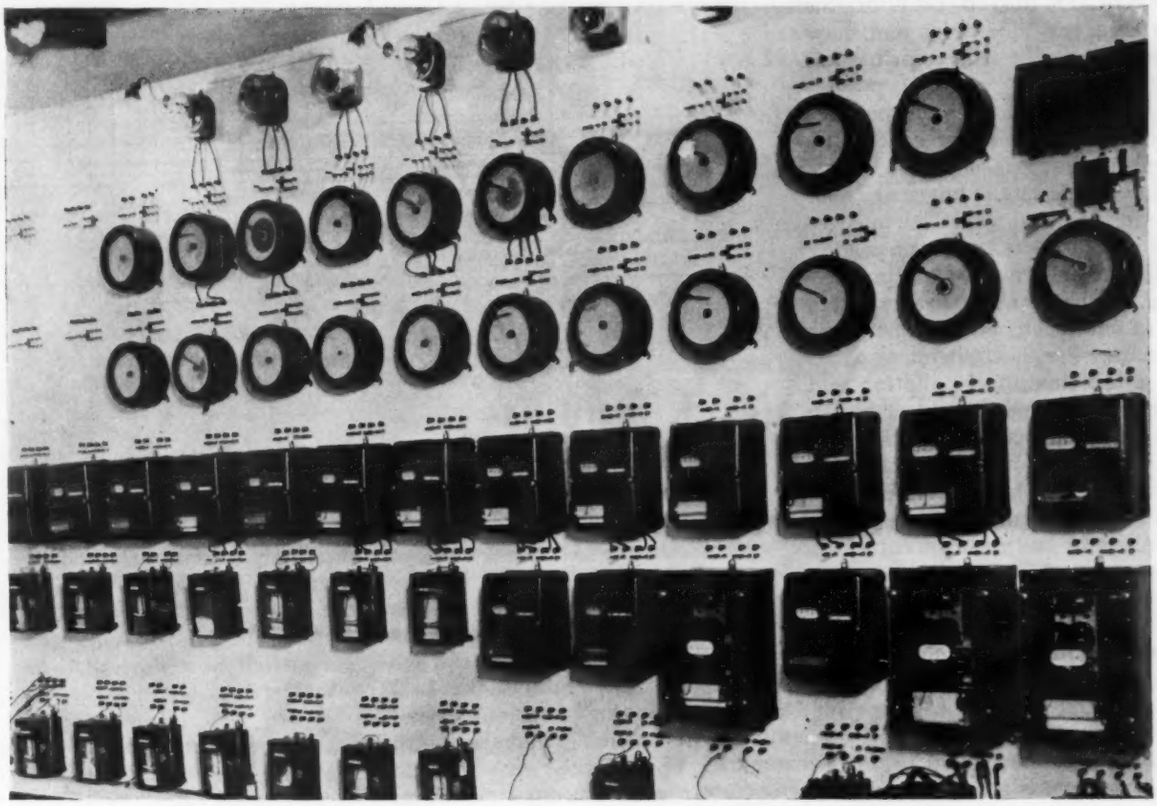
### Variety of Meters May Be Tested

Each space on the meter board is provided with four binding posts insulated for safety and the convenience of the tester and so arranged that one set of leads may be used for all types of meters or instruments that may be installed. The four lower rows permit installing 56 watt-hour meters and instruments, such as two and three-element RA demand meters, ammeters, voltmeters, watt-meters, power factor meters (at unity only), duplex RA, Westinghouse RI and other types of meters. The current supply is obtained from the house circuit and all current coils of the various meters under test are connected in series with the loading lamps and the master watt-hour meter shown in the upper corner of the meter board. Potential is obtained from the same source as that of the upper two rows of contact circuits. The main switch, which controls the entire board, is shown just below the two double contact-making relays.

In demand meters especially it has been found that the various types of clocks contained in their mechanisms must be kept running at all times to give the degree of satisfaction that is demanded of them today. If a clock is allowed to remain idle in the laboratory for as short a time as one




PLAN OF DEMAND METER BOARD DESIGNED BY MEMPHIS POWER & LIGHT COMPANY



TEST BOARD LOADED WITH SEVERAL TYPES OF METERS AWAITING EXAMINATION

or two weeks, it seldom will run satisfactorily when installed on a customer's premises without some troublesome readjusting.

With this testing board it has become possible to keep all the company's meters and other instruments that contain clocks of any description running all the time they remain in the laboratory. Likewise a very efficient means of checking the clocks, one against another and also against a master meter clock, has been developed. One man has charge of the board and is able to study the characteristics of each meter separately and diagnose trouble as soon as it appears.

Dimensions of the board when completed are: height, 9 ft.; length, 18 ft.

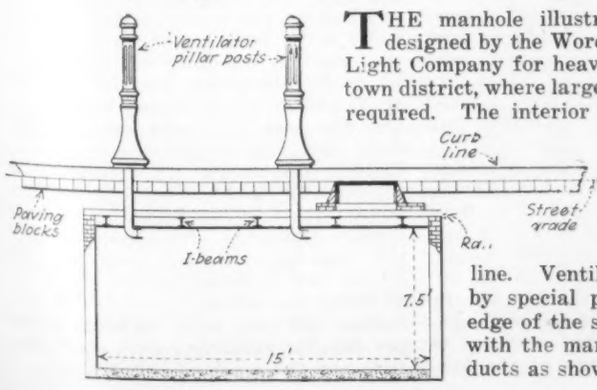
## Photostatic Record of Equipment

TEN years after a certain piece of apparatus has been installed in a power plant or substation there may—and quite frequently does—arise an acute need for certain information. This information was, quite probably, a matter of common knowledge at the time of installation, and there is no doubt that it reposes now in documentary form somewhere in the files. But, although no one will question the value of files as repositories for data and information, the file that will give up the details on a ten-year-old transaction without a bitter struggle is rare indeed.

In order to make instantly available all pertinent information on the plant and system property of the subsidiaries it serves, the United Light & Power Engineering & Construction Company maintains what might be called a supplemental property record. The record sheets, 18x22 in., are contained in ledger bindings, usually one property to a volume. The volumes are made up in duplicate, one copy going to the local office of the property and the other remaining at headquarters. The records consist of photostatic copies of prints, letters, specifications, contracts, catalog illustrations sometimes and any other information of value.

The volumes are indexed by job numbers and job titles, with subindexes referring to details. For instance, a turbine was installed in a plant five years ago. That job number is still active and as work is done on the turbine charges are made to the number and sheets are added to the record. Perhaps some new blading is to be put in. It is necessary to refer to the maker's guarantee and to the contract of sale or the instructions that accompanied the turbine on delivery. There in the record are true copies of these documents and there is no waiting or uncertainty while various files are searched. The

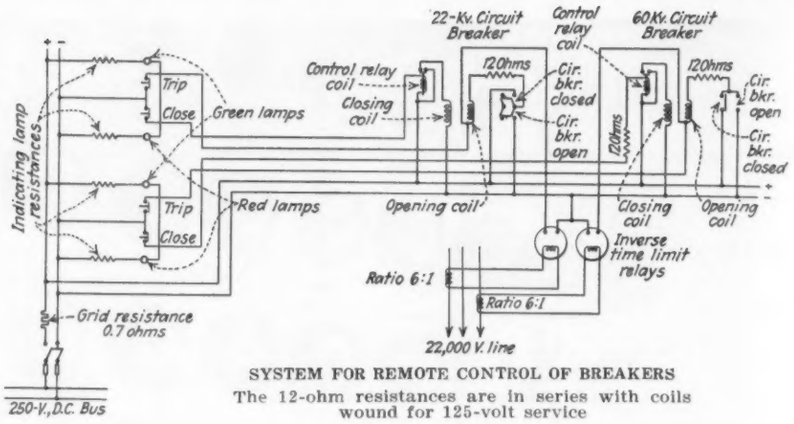
## Design of Manhole for Heavy Service




THE manhole illustrated above has been designed by the Worcester (Mass.) Electric Light Company for heavy service in the downtown district, where large transformer units are required. The interior dimensions are 15 ft. x 8 ft. 2 in. x 7 ft. 6 in., and the roof is reinforced by steel I-beams, the manhole entrance being just outside the curb line. Ventilation is provided for by special pillar posts set in the edge of the sidewalk and connected with the manhole chamber by pipe ducts as shown in the cross-section.

book contains also a copy of the manufacturer's blue print and, having the number of it, new prints are easily obtainable.

The records contain nothing but information from makers concerning equipment purchased from them; drawings made by the buyer are kept on file in the usual way. The purpose of the record books is to keep readily at hand all informative matter furnished by the manufacturer about a piece of equipment at the time of its sale, matter that is studied and pored over at the time of installation and that manifests a remarkable capacity for getting lost as soon as the particular piece of apparatus goes into operation. The books contain also the manufacturer's promises and guarantees in the form of copies of letters, contracts and specifications. If anything goes wrong with the machine, the local manager of the property may refresh his memory on the conditions of its sale and installation and may immediately take steps for repairs with full knowledge of the situation and without waiting for the file at headquarters to be rummaged.




SYSTEM FOR REMOTE CONTROL OF BREAKERS
The 12-ohm resistances are in series with coils wound for 125-volt service

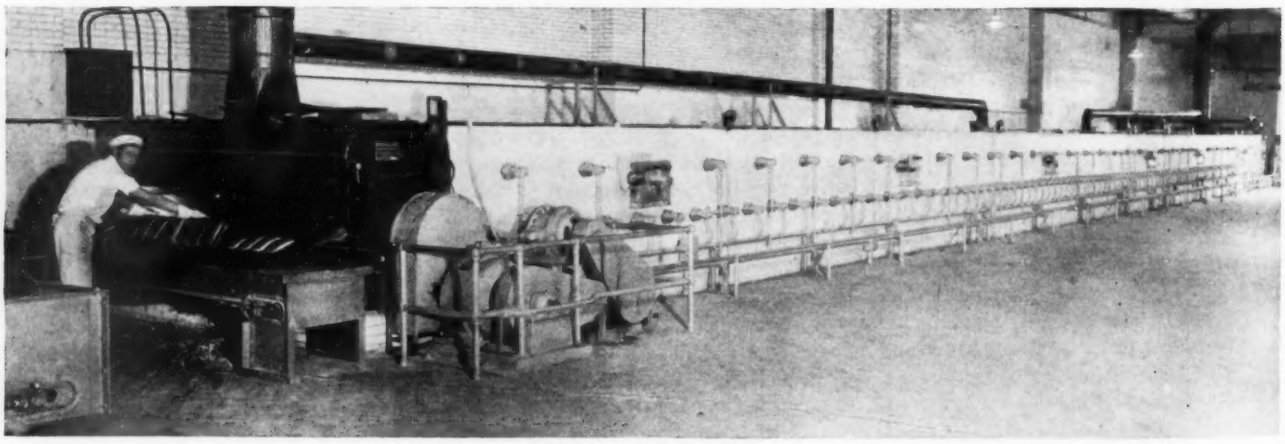
## Control Wiring for Remote Breakers

BY ALEXANDER W. H. LEE
Operating Department Manitoba Power Company, Great Falls, Manitoba

OWING to the necessity of operating a substation at a distance of about 600 yd. from the switchboard to step down from 60 kv. to 22 kv. for supplying a seventeen-mile distribution line, economy in the number of control wires to the switches became an important factor. No satisfactory scheme of connections in present use for the operation of large oil circuit breakers could be found with less than three wires per switch, excluding the positive and negative bus wires. Consequently the connections shown in the accompanying diagram giving two wires per switch were devised to meet the situation.

When put into operation, this scheme was found to be very satisfactory. This installation has been in service for over a year.

## 40,000 Loaves of Bread Daily Capacity of New Electric Oven in General Baking Company's Brooklyn Plant



A COMPLETE electrically heated bread-baking oven has recently been installed in the Brooklyn plant of the General Baking Company. According to E. A. Steinbuehler, industrial engineer of the Brooklyn Edison Company, this oven, which was manufactured and installed by the Oven Equipment & Manufacturing Company of New Haven, Conn., has a capacity of approximately 4,500 lb. of bread per hour. The oven is of the flat conveyor type, approximately 117 ft. long, 11 ft. wide and 5 ft. in height. The oven body is of structural steel supporting an Armco iron shell, to which is applied an insulation of 85 per cent magnesia block. All visible surfaces are covered with a special tile brick, giving an exterior of pleasing appearance and cleanliness. The heating elements were manufactured by the General Electric Company and are similar in construction to the standard sheath wire heaters. These units are placed in iron castings, which insure perfect heat radiation and distribution. Flexibility and temperature control are obtained by dividing the heating elements into groups.

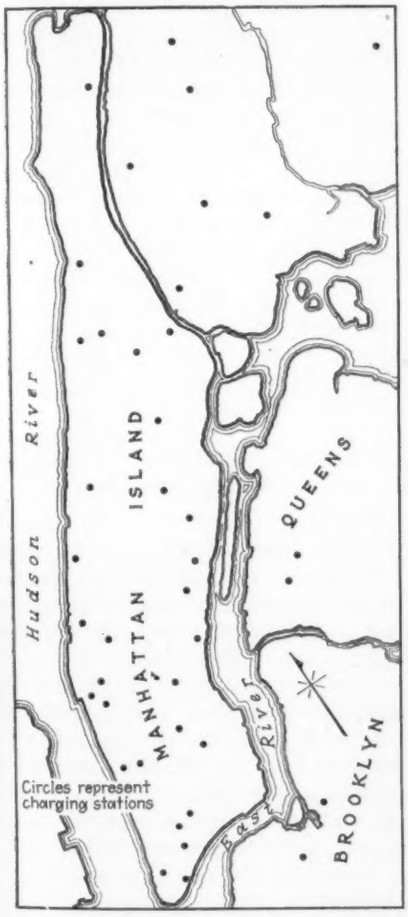
The General Baking Company is supplied by high-tension feeders of the Brooklyn Edison Company. The lines are brought into a vault owned and maintained by the baking company, where the voltage is reduced to 440 volts and made available for all the power requirements. This transformation permits the baking company to purchase electrical energy at the lowest rates applicable to this type of load.

It has been found preferable to allow the oven to remain on the line during non-baking hours rather than to shut down after baking and preheat, with the possible exception of week ends, when the oven is not used for a period of 36 hours. With this cycle of operation the oven is always ready for instant use in its saturated steady state, thereby preventing the possibility of establishing a high energy demand, which would occur if the oven were rapidly preheated. An electric oven of this type under normal operating conditions will bake approximately 12 lb. of bread per kilowatt-hour. This production will vary with the hours of use per day, the products baked, the baking time and the result of evaporation.

# Commercial Activities and Public Relations

## Utility Handbook to Aid Electric Truck Users

AN EXAMPLE of what one utility is doing to help electric truck users and incidentally give stimulus to more extensive adoption of this type of automotive equipment is provided by a booklet recently issued by the New York Edison Company.




MORE THAN 35 BATTERY-CHARGING STATIONS SCATTERED THROUGHOUT MANHATTAN AND VICINITY (MORE DETAILS GIVEN ON ACTUAL MAP)

Besides full instructions on the care and charging of truck batteries, the book contains charging rates for storage batteries, typical monthly garage rates, names and addresses of electric truck garages, motor-truck, battery, charging-apparatus and accessories manufacturers. The locations of all battery-charging stations are indicated on a map and also described with capacity, rates, and hours of service in many cases. A map of improved automobile roads within a 50-mile radius of New York City, ferry schedules and instructions for licensing cars make the book extremely handy for truckmen and delivery superintendents whether or not their fleets include electric vehicles.

## Power Company Has Permanent Farm Equipment Display

SUCCESSFUL farm electrification depends almost altogether upon the extent to which the farmer utilizes electrically operated equipment in his everyday chores, thereby making his investment an economical one for him and at the same time making him a profitable customer of the power company. One of the problems in promoting greater use of electrical farm chore equipment has been that of a practical method of its display and demonstration. Unless a farm already has electric service the implements cannot be operated on the ground and demonstrations at group meetings are not always the most satisfactory, because they come at infrequent intervals and lose the effect of continuity.

These difficulties have been met by the Ohio Public Service Company by establishing a permanent display of electrically driven farm equipment in the store of the Farm Implement Company at Elyria, Ohio. The display, as shown in the accompanying illustration, consists of motor-driven feed grinders, corn shellers, milking machines, cream separators, water pumps, clipping machines, utility farm motors, miscellaneous small tools and chicken brooders.

In arranging this display Dudley W. Rice, rural lines representative of the Elyria and Lorain divisions of the Ohio Public Service Company, invited various electrical manufacturers to lend suitable equipment to help make up the exhibit. The Century, General Electric, Wagner, Westinghouse and Fairbanks-Morse companies accordingly consigned electrical farm apparatus to be used as long as the display was maintained.

All equipment was wired and connected by the Ohio Public Service Company. Lighting was furnished by RLM dome reflectors, and charts were made showing the effect and savings from the application of electricity to farm operations. The expense of making the installation as well as the cost of energy consumed will be carried by the Ohio Public Service Company as part of its share of the cost of the exhibit.

The value of having the display located in a farm implement store lies in the fact that the farmers are

UTILITY DISPLAY OF ELECTRICAL FARM EQUIPMENT IN IMPLEMENT STORE

accustomed to visit places where agricultural machinery is usually found. Also, the men in the store are thoroughly familiar with the operation of farming equipment, and although the utility men are able to explain the electrical features, they do not, as yet at least, talk the same language as the farmer.

When the display was first opened, announcements were sent to all existing and prospective rural customers in the company's Elyria-Lorain territory and admission was by card only during a three-day meeting of the local Grange. It is significant to note that during the first two days, Thursday and Friday, only about sixty farmers visited the display, but on Saturday more than 300 attended, and of this number 100 good prospects for the purchase of electrical equipment were obtained.

Although this display was started by the Ohio Public Service Company, which will support it with advertising and sales assistance on electrical apparatus, actual sales of equipment are being handled entirely by the Farm Implement Company. This exhibit is the first step in a general program of farm electrification in its territory by which the Ohio Public Service Company feels it can make this class of business definitely profitable.

# Electric Water Heating in Rural Districts

REMARKABLE progress has been made in the development of electric water heaters, which are entirely satisfactory in performance, and where the rate for energy is favorable, the cost of operation is by no means prohibitive, particularly when the added convenience, absence of dirt or smoke and almost complete freedom from attention are considered. The sale of electric water heaters goes hand in hand with the sale of electric ranges, and where the latter are to be installed, the method of water heating must be considered.

In order to ascertain the merits of electric water heaters as compared with fuel-fired types, particularly when used in rural districts, Robert Montgomery, sales manager of the Louisville Gas & Electric Company, recently made a study of the performance and cost of operation of a number of water heaters of various types in use in customers' homes.

As a result of this investigation he concludes that the majority of prospective purchasers of electric ranges demand a continuous hot water supply and are willing and able to spend a few dollars more per month in order to enjoy the convenience that the electric water heater affords.

The most economical method of heating water for a large family is by means of coal or coke-burning heaters, but such heaters are rarely used except in cases where hot water requirements are unusually large and where more than one servant is employed, as this heater requires more attention than perhaps any of the other types. It also has a tendency to heat the basement, which is objectionable. A gasoline heater was also tested, and although a tank of water could thereby be heated much more quickly than by the kerosene heater, it proved to be very much more expensive to operate.

The most commonly used and most economically operated oil heater for a moderate size family, according to Mr. Montgomery's investigation, proved to be the kerosene type. Therefore a very thorough test was made of one of these heaters in order to compare the cost with heating water electrically. A one-burner wick-type tank heater of the most efficient make was connected to a 40-gal. hot water tank in a home having two bathrooms, sink and servants' washstand in the kitchen and laundry tubs in the basement. The water tank and piping were not insulated. The temperature of the water supply during the test was 59 deg. F. The family consisted of two people and one servant, who lived on the premises and used one of the bathrooms. No laundry work was done on the premises except the servant's linen.

### Cost of Heating Water with Kerosene

For ten days this heater was lighted at 6 a.m. and extinguished at 7 p.m. Starting with a tank of cold water in the morning, the burner was turned to maximum height in order to heat sufficient water for use in the bathroom at 7 a.m. At 7:30 a.m., after the water in the tank had become hot, the flame of the burner was reduced. Operated in this manner, the heater consumed three quarts of kerosene per day, provided the servant remembered to reduce the flame at 7:30 a.m. When the servant failed to light the heater at the proper time, there was no hot water available at 7 a.m. Therefore the heater was burned continuously for 30 days with the flame reduced to the lowest possible point at which a blue flame could be produced. Plenty of hot water was available at all times and the heater required no attention except refilling the 1-gal. reservoir with kerosene and cleaning the wick daily. In 30 days the heater consumed 30¼ gal. of kerosene costing 22 cents per gallon, making the total cost for the month $6.67.

For several days the heater was lighted for only two hours in the morning and extinguished after members of the family had finished bathing. Operated in this manner, the heater consumed 1 gal. of kerosene in six days, which would be equivalent to 5 gal. per month, at a cost of $1.10. Reference is made to this particular test for the reason that some families in rural districts seem to be satisfied with such limited hot water service.

### Water Heated Electrically for $7 a Month

Following these tests a 15-gal. thermos type electric water heater was installed, independent of the 40-gal. hot water tank, the latter being cut off with a valve in the hot water line. This heater had two 1,500-watt heating elements automatically controlled by a thermostat, both units being cut in until the temperature of the water reached a certain point, when one of them cut out and the other continued to operate until the water reached a temperature of 150 deg., for which the thermostat was adjusted. When small amounts of water were drawn —for a bath, for instance—and the temperature of the water in the tank was reduced sufficiently, both units were cut in. This heater was so well insulated that it operated at a high efficiency with very little heat loss.

This electric heater was operated continuously for 30 days, furnishing a sufficient supply of hot water, the requirements being the same as when the kerosene heater was tested. During the 30-day period it consumed 300 kw.-hr. The rate for this service being 3 cents per kilowatt-hour, the cost for electricity was $9 a month.

In order to reduce the energy consumption to the lowest possible value

## Electrically Warmed Plant Box for Nurseries and Farms

THIS hot bed is warmed electrically by a single No. 20 resistance wire placed in the bottom of the box on porcelain knobs before the box is filled with earth. It has been found that 100 watts is sufficient for producing the underwarmth necessary for growing ferns, flowers or vegetables such as tomatoes, cabbage, cucumbers, potatoes, etc. The experimental box shown is 2½x4 ft. and is in use by F. W. Griffith of the Puyallup Nursery at Puyallup, Wash. The device has already proved invaluable to the nurseryman and may find a wide field of application on the farm for starting flowers and garden plants requiring underwarmth for rooting.

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a two-period time switch was installed and set as follows: On, 5 a.m.; off, 9 a.m.; on, 2 p.m.; off, 7 p.m. Operated in this manner, there was sufficient hot water for all requirements, as very little hot water was used in this particular household between 10 a.m. and 4 p.m. When the current was cut off at 7 p.m. by the time switch, there was sufficient hot water stored in the tank for use until the family retired, the hot water requirements being small in the evening, as members of the family bathed in the morning. The monthly consumption, with time switch operating as described, was 237 kw.-hr., making the monthly current cost $7 at the rate of 3 cents.

The difference in cost of operation of the electric heater over other types is not so great as it first appears, especially since in recent years the cost of operating fuel heaters has been rising* whereas the cost of electric energy has been steadily decreasing. If this trend continues, the day is not far distant when electricity will be used generally in rural districts for water-heating purposes, Mr. Montgomery believes.

*A comparatively few years ago kerosene was sold by the grocer for 8 cents per gallon, and at that time electric rates in rural districts for water heating purposes ranged from 15 cents per kilowatt-hour upward. Today kerosene retails for 22 cents per gallon, whereas the electric service rate in rural districts around Louisville permits a customer to operate a water heater at the very low rate of 3 cents per kilowatt-hour.

## Kansas City Company Holds Domestic Refrigeration Show

BY B. J. GEORGE
Industrial Engineer Kansas City Power & Light Company
Kansas City, Mo.

AN ELECTRIC refrigeration show in which eight companies took part was sponsored by the Kansas City Power & Light Company at its electric shop from Monday, Feb. 28, to Saturday, March 5. The show was open from 8:30 a.m. to 10 p.m. The rear part of the main floor of the electric display room was transformed into booths containing the different makes and models of domestic electric refrigeration. The larger portion of the display window space was devoted to the different electrical refrigerators. The machines exhibited consisted of the Stacold, Iroquois, Zerozone, General Electric, Absopure, Frigidaire, Kelvinator and Copeland.

The show, under the direction of Vice-President C. F. Farley of the Kansas City Power & Light Company, was widely advertised in advance. No admission charge was made. The exhibit was a purely educational one in which expert demonstrators told the story of electric refrigeration—what it is, what it does, why it costs less and why it is so rapidly replacing other refrigeration. Exhibitors demonstrated "electric refrigeration cookery," whereby the housewife can prepare salads, ices and other food delicacies.

An interesting feature of the exhibit was the fact that the competing companies readily co-operated in the undertaking. The power company retails the Kelvinator. The show promises to be profitable to the exhibitors. Each exhibitor sold at least one machine from the floor to a "cold" prospect.

The exhibit included only domestic machines, none of the commercial machines used in restaurants, drug stores, meat markets and so forth being shown. It was estimated that 25,000 persons attended.

PART OF WINDOW DISPLAY AND ARRANGEMENT OF REFRIGERATORS IN SHOWROOM

# Digest of Electrical Literature

## Generation, Control, Switching and Protection

*How Electric Circuits Are Opened by Circuit Breakers.*—B. S. BURKE.—Opening an electric circuit with an automatic circuit breaker involves more than is sometimes appreciated. This article undertakes to explain in some detail how a circuit is interrupted by an air-break circuit breaker and by an oil switch.—*Power*, March 22, 1927.

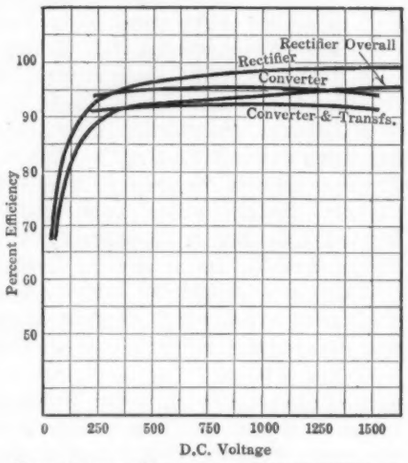
## Hydro-Electric Development and Steam Equipment

*Modern Steam Turbo-Generators.*—R. POHL.—In this article are outlined the physical limits of 50-cycle generators of 3,000, 1,500 and 1,000 r.p.m., in accordance with the latest mechanical and electrical achievements in the design of high-speed steam turbo-generators. These limits are set primarily by the required length of the rotor. Formerly the heat dissipation set the upper limit. New winding and ventilating methods have overcome this problem, leaving only the bending of the shaft and the critical speed as present barriers. Considering only two-pole or four-pole rotors, a solid forging with rotor and shaft in one piece for the former and a forged hollow cylindrical rotor with an inserted short shaft at each end for the latter type are now standard practice. Such constructions will stand up safely under peripheral speeds of up to 475 ft. a second (equivalent to 325 miles an hour). For 3,000-r.p.m. types a rotor length of 10 ft. and an output of 40,000 kva. is now the limit. At 1,500 r.p.m. the length may be increased safely to 14 ft. with a limit output of 100,000 kva. for the two-pole rotor. Four-pole rotors may be built for up to 135,000-kva. unit output. The author believes that it will be possible to build disk-type rotors with relatively small and elastic shaft for 3.000 r.p.m. and 60,000 kva., with a length of 15 ft. and more. Similarly four-polar drum-type rotors can be made as long as 25 ft. with 170,000 kva. output. A further increase is possible with hydrogen cooling, resulting in a unit capacity of up to 225,000 kva. This, however, already approaches the point of shipping difficulties. The author investigates the additional losses in large machines and discusses means for their suppression. Finally, air cooling and fire protection are elaborated. —*Elektrotechnische Zeitschrift*, Feb. 10 and 17 and March 10, 1927.

## Transmission, Substations and Distribution

*A 21,000-Kva. Automatic Substation.*—D. W. ELLYSON.—Present practice in the design of distribution substations shows a tendency toward the more extensive use of automatically controlled equipment to replace the older manually operated type, according to the author of this paper. The paper is of interest, therefore, because it presents an example of the type of equipment used by one company and also some of the reasons why this type was decided upon. It contains a summary of the apparatus and control equipment, the general scheme of operation, together with floor plans of the building, one-line diagrams illustrating the operation and a view of a portion of the single-phase regulator equipment. A summary is added showing the total kva. capacity of the apparatus that is automatically controlled.—*Paper presented at the regional meeting, A.I.E.E., Kansas City, Mo.*, March 17, 1927.

*Application of Mercury-Arc Power Rectifiers.*—C. A. BUTCHER.—This comparatively short paper deals with the characteristics of the modern large power rectifier compared with commutating machines. Cost comparisons of rectifiers and synchronous-converter automatic substations at 600 volts direct current for service of low load factor are given. Some discussion is devoted to weight and space requirements of converter equipment.—*Paper presented at the regional meeting A.I.E.E., Kansas City, Mo.*, March 17, 1927.




COMPARATIVE FULL LOAD EFFICIENCIES OF RECTIFIER AND 60-CYCLE CONVERTER

*Equipotential Operation of Three-Phase Networks.*—B. JANSEN.—In an attempt to minimize the cost of generating power and to increase reliability of service, modern tendencies are toward tied-in bus systems and ring networks. The unavoidable voltage drop between feeding centers and substations makes it difficult to control the desired distribution of power and at the same time to keep the voltage at its nominal value. Variations of load and voltage, to which is added as a third variable the power factor, represent grave problems in large three-phase networks. The advent of the synchronous condenser, with which voltage and power factor regulation is readily possible, was welcomed as the solution of this problem, only to find soon that the solution was at the expense of economy. Developments of the last few years indicate that these problems can be solved with much higher economy if the synchronous condenser is relieved of its duty of voltage regulation, and that this is accomplished by load-ratio-control transformers; that is, by transformers the voltage taps of which can be changed without dropping the load. The characteristics of this regulating method are explained for a straight transmission line, a transmission loop and for a tie between two systems. By means of a graphic representation of distance and corresponding line drop, the voltage conditions of transmission lines are indicated for these three cases. —*Elektrotechnische Zeitschrift*, Feb. 3, 1927.

## Units, Measurements and Instruments

*Dielectric Strength of Bakelized Paper.*—F. GRÜNEWALD.—Cylinders, tubes and plates made from a great many layers of bakelite-soaked paper, under application of heat and pressure, have become indispensable building materials for all kinds of high-voltage apparatus. Although this material appears homogeneous and is actually very strong mechanically, its laminated structure is readily disclosed under the microscope. The dielectric strength of bakelized paper is naturally considerably higher across its laminas than along them. A systematic series of tests is described in this article. These were made on cylinders and plates with 50-cycle alternating current, with high-voltage direct current and with alternating-current impulses under oil. Two types of electrodes were used. Either a hole $\frac{1}{8}$ in. in diameter was drilled not quite through the cylinder wall and lead was poured in the hole to form a metallic plug for one electrode, with a cylindrical electrode snugly fitting the interior of the tube, or thin metal foils were embedded in the cylinder a certain wall thickness apart while the cylinder was wound. On cylinders the direct-current puncture was found much higher than the 50-cycle alternating-current puncture, while the impulse puncture gave about the same values as the 50-cycle tests. With plates, on the other hand, the impulse values were very much higher than on either the alternating-current or the direct-current tests. No noticeable difference was found on plates, when impulse-tested, between the temperatures of zero and 110 deg. C.—*Elektrotechnische Zeitschrift*, Jan. 27, 1927.

## Illumination

*Transmission of Light Through Window Glass.*—E. H. HOBBIE and W. F. LITTLE.—The study of the transmission of daylight through different types of sheet window glass is expensive and difficult to carry on, according to the authors, because of the large area which must be glazed for different kinds of glass and the many variables met with. On the other hand, the use of a model is entirely practical when adapted to actual conditions found in the building, and under such conditions the influence of the glass over the illumination may be accurately determined. This method has been employed,

and data for both an actual building and a model under comparable conditions are set forth.—*Transactions of Illuminating Engineering Society*, March, 1927.

*Making Windows Deliver Daylight.*—W. C. RANDALL and A. J. MARTIN.—Dirt collects on windows in such a way that the amount of light which passes through constantly diminishes. This has been determined experimentally and checked in the field. The decrease in transmitted light is proportional to the length of exposure to dirt-laden atmosphere and to the slope of the glass. Sloping the glass to admit more light is not justifiable unless the glass is kept clean. There is not much difference between the various types of glass in regard to the collection of dirt, but certain types are easier to clean than others. The proportion of dirt on the inside and outside of glass has been studied, according to the author, the greater part usually being found on the inside. When windows are washed but once a year this should be done in the fall in order to have the advantage of relatively clean glass in the winter, when natural illumination is at its lowest value.—*Transactions of Illuminating Engineering Society*, March, 1927.

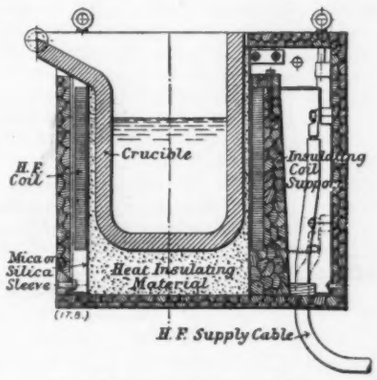
## Motors and Control

*Time Sequence for Starting Large Motors.*—HEINZ VOIGT.—Central stations for industrial areas have usually a generator capacity which is less than the combined output of all installed motors. Proper operation depends in this case upon the diversity factor of the connected load. Mining districts with electrically operated hoist experience difficulties in this respect, because it happens rather frequently that two or more of the large hoist motors are started simultaneously. It is therefore suggested to install in front of each hoist operator an instrument with a pointer which revolves constantly. The pointer is driven by a small synchronous motor with such a gear reduction as to make one complete turn every minute. All these instruments are connected to the same three-phase supply, and their pointers will therefore not only revolve at the same speed, but every pointer will be at a given instant in the same position. The dials at the various mines are marked with a white sector covering about 90 deg. of the dial and a black sector of 270 deg. This dial is in a different position at every mine, and the operator is allowed to start his hoist only while the pointer of his instrument is within the white sector. A starting of more than one motor at a time is thus avoided.—*Zeitschrift des Vereines Deutscher Ingenieure*, March 5, 1927.

*Electricity in the Drilling of Oil Wells.*—L. J. MURPHY.—Electricity has taken the lead in the petroleum industry in putting the drilling of oil wells on an engineering basis, with the result that electric drilling has become accepted practice by the majority of oil companies at the present time. Easy operation, low maintenance, low power bills, fewer shutdowns, perfect motion, faster drilling, heavier pulling and the absence of standby losses have all contributed to make electricity the accepted standard by which all other forms of oil-well drilling are to be judged.—*Paper presented at the regional meeting, A.I.E.E., Kansas City*, March 17, 1927.

## Traction

*Electric Furnaces in Non-Ferrous Metallurgy.*—D. F. CAMPBELL.—In this paper the author gives a short survey of the metallurgical field in which electrical heating can be economically applied at the present time and indicates the lines of possible expansion. Single furnaces of 4,000 kw. to 10,000 kw. are now engaged in smelting pig iron and in the manufacture of carbide, while about 500,000 kw. of furnace capacity is engaged in smelting metals, to which must be added a million or more kilowatts of generating machinery used for making aluminum and smelting ferro-alloys. A few of the general principles which seem necessary in the design of an efficient electrometallurgical furnace are detailed by the author. The newest forms of melting equipment are described and their advantages over older equipment enumerated.—*Engineering* (*England*), March 18, 1927.




NOSE-TILTING 600-LB. HIGH-FREQUENCY FURNACE

*Improved Electric Tramcars.*—This article deals with an account of the two new cars built for experimental service on the North London system of the Metropolitan Electric Tramways, Ltd. Their features, as outlined in the article, are light weight, high acceleration, smooth running and passenger comfort.—*Electrical Review* (*England*), March 11, 1927.

## Electrophysics, Electrochemistry and Batteries

*Photo-Electric Emission as a Function of Composition in Sodium-Potassium Alloys.*—H. E. IVES and G. R. STILWELL.—This paper reports an investigation of the entire series of sodium-potassium alloys with respect to occurrence of the "normal" and "selective" photo-electric effects. The series have been investigated with respect to the relative values of a photo-electric current produced by light polarized with the electric vector in and at right angles to the plane of incidence. The pure metals when molten exhibit values below three for the ratio of the two emissions; the alloys show three maxima at compositions approximately 20, 50 and 90 atomic per cent of sodium, with values from 10 to 30 for the ratio. The minima between show low values approximating those for the pure metals. The maxima and minima of the ratio of emissions are due to complicated variations in magnitude of the two emissions compared.—*Bell Telephone Laboratories Reprint B-238*, March, 1927.

*"Glyptal," a New Synthetic Resin.*—H. WARREN.—This article deals with the application of a new synethic resin to the electrical industry. A new product known as "glyptal" has proved, according to the author, a distinct improvement on the phenol-formaldehyde resins in respect to three particular properties — resistance to arcing and discharge, flexibility, and ability to bond mica, and its application to the electrical industry and general commercial uses promises to be a matter of some importance.—*Electrician* (*England*), March 18, 1927.

## Telegraphy, Telephony, Radio and Signals

*Notes on Design Details of a High-Power Radio-Telegraphic Transmitter Using Thermionic Valves.*—R. V. HANSFORD and H. FAULKNER.—This paper deals with certain specific details of design and operation of the high-power valve transmitter installed at the Rugby radio station. The arrangement of the coupled aërial circuit of a valve transmitter is discussed, and it is shown that certain circuits have considerable advantages over others in respect to the elimination of harmonics. The considerations which govern the choice of the electrical proportions of the intermediate and aërial circuits are indicated, and simple formulas are given for the calculation of the different quantities involved. The question of the design of large inductance coils is dealt with, and measured values of the high-frequency resistance of certain coils with the calculated values are compared. Results are given of recent signal measurements, and a schedule of ratings under present normal working conditions is appended to the article.—*Journal of Institution of Electrical Engineers* (*England*), March, 1927.

*Vacuum-Tube Measuring Instrument.*—E. ROMHILD.—To determine the electrical characteristics of a vacuum tube requires complex connections between batteries, resistances, instruments, etc., and calls for the skill of a laboratory operator. The complications increase when various kinds of tubes are to be tested. For such purposes—and, in particular, for routine testing by unskilled persons — a semi-automatic measuring instrument is described in this article. The glider of a potentiometer is mechanically connected to a movable straight edge, and readings from a directly indicating instrument can be plotted along the straight edge while it is moved over a piece of coordinate paper. All necessary accessories are combined in a portable set. Its correct operation requires a minimum of skill.—*Elektrotechnische Zeitschrift*, Feb. 3, 1927.

# News of the Industry

## Once More the Big Meeting

**Initial Arrangements Made and Special Trains Chartered for N.E.L.A. at Atlantic City**

HOTEL and transportation circulars have been distributed to members of the National Electric Light Association in every part of the country, and preliminary arrangements for the great gathering of that body at Atlantic City on June 6 to June 10 are completed. Association activity on the Million-Dollar Pier, where the convention will be held, will be in full swing on Saturday, June 4, for, as previously announced, the innovation of opening the manufacturers' exhibition on that date will be made. This will allow a full week for the inspection of apparatus and exchange of experiences with equipment in the favorable practical atmosphere of the machinery display.

President R. F. Pack announces officially that the business program of the convention "will be of the highest order, devoted to matters of vital concern to the industry, the subjects being presented by the foremost authorities." As always, an excellent and varied entertainment program is also to be provided.

Arrangements have been completed with the Pennsylvania Railroad to run two special trains from Chicago to Atlantic City with special Pullmans from Detroit and Cleveland, which all Western delegates and visitors are urged to use. The schedule for these trains has been arranged so that they will depart from Chicago, one on Saturday, June 4, and one on Sunday, June 5, at 12.45 p.m., Central standard time, immediately following the departure of the Broadway Limited. The special train leaving Chicago on Saturday is an innovation. Its arrival in Atlantic City on Sunday morning will afford passengers an opportunity to inspect the exhibits prior to the formal opening of the convention. No arrangements have been made for special trains from New York or other Eastern points to Atlantic City in view of the frequent train service.

## Los Angeles Wins Point in Fight Over Steam Plant

The right of the city of Los Angeles to build a steam-electric plant on a site at San Pedro, the city's harbor, was supported on April 4, when Judge Schmidt in that city sustained its demurrer to the complaint of the Southern California Edison Company, which, as previously reported, maintained that under the agreement entered into between the city and the company at the time when Los Angeles acquired the company's distribution system the projected plant could not be built. That contract, as interpreted by the company, provides that the city shall purchase from the company all electricity needed in addition to that generated by the city's own plants on the aqueduct.

## Wisconsin Water-Power Act Argued at Washington

The constitutionality of the recapture clause of the Wisconsin water-power act as well as that of the federal water-power act was placed in issue before the United States Supreme Court on April 11 by the owners of the middle Appleton dam in the state named. Owners of the dam are appealing from a decision of the Wisconsin Supreme Court in Fox River Paper Company vs. Wisconsin Railroad Commission, contending that the provision of the Wisconsin water-power act permitting the state to recapture any water-power development after 30 years is unconstitutional in that the water capacity of a stream is a property right appurtenant to the upland and that the state does not allow compensation for any increase in the value of the undeveloped power of a stream between the time of issuing the permit for development and the time of recapture.

Adolph Kanneberg, a member of the Wisconsin Railroad Commission, argued that the water-power capacity of a stream is not a riparian right and that the riparian owners, having no "vested property right in the water power inherent in the falls and rapids of the river and no right to place in the river the works essential to any practical use of the flow of the river, the government cannot be justly required to pay for an element of value which did not inhere in these parcels as upland." His second outstanding contention was that the public rights in public waters are not limited to the improvement of the stream for navigation, but include all public rights and that all riparian rights are subordinate to all public rights. The state in recapturing from the riparian owner a right surrendered for a period specified in the statutes, he argued, is under no obligation to pay for that part of the development which never belonged to the riparian owner.

"Compensation for the undeveloped power of a stream," he said, "cannot be claimed, because (1) the energy in falling water is not a riparian right, (2) developed power is appurtenant to the dam and not the riparian lands, (3) a dam may be constructed only by the state or under authority of the state. The energy developed by falling water has its source in something not capable of ownership and, therefore, either no one's property or the property of the state. If the Wisconsin act is declared unconstitutional, the federal water-power act will also fall, because, like the Wisconsin act, the federal recapture clause does not provide compensation for the increased value of the water capacity of the stream."

## Conowingo Power in 1928

**One Unit to Be Ready in June, Then One a Month Till End of Year—Holtwood and Conowingo**

WALTER H. JOHNSON, president of the Philadelphia Electric Company, announced on Wednesday at the annual stockholders' meeting of that company that electrical energy will begin to flow into Philadelphia from the Conowingo hydro-electric plant in June, 1928. This is the first announcement setting an exact date for the opening of the plant at Conowingo. At the time stated the first unit will be ready for operation, and the other six units will be placed in service one each month, so that by the end of next year the entire plant will be in operation. When fully completed the Conowingo project will supply for Philadelphia 1,150,000,000 kw.-hr. annually.

In the annual report of the Philadelphia Electric Company for 1926, just issued, President Walter H. Johnson reveals that the agreement entered into more than a year ago with the Pennsylvania Water & Power Company will add 94,000,000 kw.-hr. annually to the output from the Conowingo hydro-electric plant. According to the terms of the arrangement as noted in the ELECTRICAL WORLD for June 12, 1926 (page 1313), permission was given to the Philadelphia Electric's subsidiary, the Susquehanna Power Company, to superimpose gates on top of the Conowingo Dam which would back water into the tailrace of the Pennsylvania Water & Power Company's Holtwood plant, thus causing some reduction in output there although increasing to a much greater extent the output at Conowingo. Under a 50-year contract the Pennsylvania company will first be recompensed for the loss at Holtwood and then the net gain at Conowingo will be divided between the two companies.

## Ottawa Committee Kills Canal Bill Affecting Carillon

One stage of the fight in the Canadian Parliament over power rights on the Ottawa River, including Carillon, was abruptly ended on April 7, when the bill to renew the Georgian Bay Canal charter was killed by the railway committee of the House of Commons. If granted, the charter would have permitted the company to construct a ship canal from Georgian Bay to the St. Lawrence River via the Ottawa River and have given it all the subsidiary power rights. The Provinces of Ontario and Quebec were, as already reported in these columns, opposed to the bill and members of the House of Commons who advocate the public ownership of electric power also made a concerted attack against it. Although the measure was overwhelmingly de-

feated, not a single witness appeared to speak in opposition to it, except counsel representing the Province of Quebec, who in a single sentence said that both his province and Ontario were strongly opposed.

There is considerable speculation now as to what move will be made to develop Carillon Falls. The only interest having a claim to that right at present is the National Hydro-Electric Company, whose charter expires on May 31, 1927. It is altogether likely a conference will be held between representatives of the Dominion government and the Provinces of Ontario and Quebec in an effort to arrive at a decision.

Replying to the charge made by Harry Sifton, one of the promoters of the Georgian Bay Canal project, that the Ontario Hydro-Electric Power Commission was "hand in glove" with the "Montreal power trust," Premier Ferguson of Ontario said: "It is quite evident that he is pushing the Sifton claims without full knowledge of the facts. You have my assurance that the Hydro is tied up with no interests."

# Memphis N.E.L.A. Meeting a Big Success

### Achievements and Opportunities of Southeastern States, Based on Electrical Development, Are Recounted by Those Directing Them and by National Officials

SOUTHERN hospitality, exemplified by the city of Memphis, the Memphis Power & Light Company and the Southeastern Geographic Division of the N.E.L.A., made possible this week the most successful convention this division has known in its fifteen years of existence. With more than six hundred delegates and guests registered, men of national prominence speaking on vital subjects to the industry and committee reports of unusual completeness, the convention proved invaluable to those in attendance. Two themes dominated the program—commercial development and the merchandising of household appliances. A great deal of work has been done throughout the section along these two lines of activity.

When the convention opened Wednesday morning Mayor Rowlett Paine of Memphis made an address of welcome, to which P. S. Arkwright, president of the Georgia Power Company, responded. In his presidential address B. C. Edgar of the Tennessee Electric Power Company reviewed the growth of the division during the past year and outlined the activities of the various section committees. He pointed out that last year's record of growth and advancement of the electric industry in general was reflected in an even greater measure among the central-station operating companies in the Southeast. Energy generated by utility plants in 1926 amounted to 5,800,000,000 kw.-hr., an increase of 20 per cent over the previous year. In the six Southeastern states generating capacities have increased 75 per cent during the past four years. The number of customers increased to almost a million, a gain of 10 per cent, whereas the national figure was 8 per cent. Moreover, in the past year more than forty municipalities in the Southeastern division have either sold their municipally operated plants to private companies or have begun to purchase their energy from these companies.

In speaking of commercial development, Mr. Edgar said that the logical way to bring this about is the aggressive sale of merchandise. Many of the companies are firmly committed to this policy. Major appliances must be financed on the time-payment plan. Another phase of residential load building emphasized was adequate illumination in the homes, a phase too long neglected. The opportunity for load building through this medium is tremendous, Mr. Edgar declared.

R. F. Pack, president of the N.E.L.A., spoke of the extent of interconnection throughout the country and the advantages and economies accruing therefrom. He uttered a word of caution on water-power development. At the present time hydro-electric developments are very costly, he said, and in many instances energy can be generated less expensively by advantageously located modern steam plants. The utilities must not let the public believe that energy generated by water power costs nothing. It must tell the complete story of hydro costs, clearing, plant and dam construction, substations and often very long transmission lines.

Mr. Pack dwelt at length on municipal and government ownership, declaring that the situation must be fairly met by the utilities and everything possible done to discredit unjust attacks against them.

Paul S. Clapp, managing director of the N.E.L.A., after speaking of the advances in the application of electricity made in the Southeast, showed how the provision of power which interconnected systems are making, particularly in agricultural sections, also helps to bring a wider interfusion of agriculture and industry. The decentralization of industry and the location of a larger number of factories in agricultural areas is mutually beneficial to both. The electric light and power industry, he said, through its completion of a network of interconnected lines, is laying the foundation upon which both the stabilization of agriculture and better factory conditions can be achieved.

Declaring that preliminary estimates of future needs of ten Southern states by 1940 indicate that an average increase of 450,000 installed horsepower per year will be required, T. W. Martin, president of the Alabama Power Company, in the Thursday morning session, said that this will mean an annual average investment of $150,000,000 in Tennessee, Kentucky, Arkansas, Louisiana, Mississippi, Florida, Alabama, Georgia and North and South Carolina in new power generating and distributing facilities, with four times that investment in new industries. Mr. Martin pointed out that the proposal to withhold from public use any substantial portion of the water powers of the South—for instance, in the Tennessee River basin—would seriously impair agricultural and industrial progress. Confronted with a steady industrial growth, power companies are ready to anticipate rather than await the future demand.

The economic value of the joint use of poles and the necessity of uniform agreements and proper consideration of all requirements was discussed by H. L. Wills of the Georgia Power Company. All of these factors are involved in the agreement on the joint use of poles approved by the N.E.L.A. Miscellaneous methods increase capital investment needlessly and enormously.

G. M. Gadsby, West Penn Power Company, in a paper presented by F. D. Mahoney of the same company, emphasized the need of saturating territories already served with energy-consuming devices. Utilities are too prone to neglect old ground for new towns and territories, thus missing great opportunities. Other addresses included "Electrical Appliances as Aids to the Industry," by J. F. Gilchrist, Commonwealth Edison Company; "Stimulating Sales Activity," by J. S. Tritle, Westinghouse; "Industrial Progress Through Decentralization," by Dr. H. A. Morgan, president of the University of Tennessee; "Progress in Rural Electrification," by Dr. E. A. White; "Organizing Public Speakers for Making Friends," by W. S. Vivian, Middle West Utilities, and speeches by General H. H. Hannah, chairman of the Railroad and Public Utilities Commission of Tennessee; Earl Whitehorne, commercial editor ELECTRICAL WORLD, and Miss Isabell Davie.

## Power and Fuel Interest the A.S.M.E. at Kansas City

Papers and discussions on power plants and fuel occupied the major portion of the time and interest of the members of the American Society of Mechanical Engineers who gathered at Kansas City on April 4 to 6 for a regional meeting.

Vern E. Alden of Stone & Webster, speaking at the power session, predicted higher steam temperatures, increasing use of pulverized fuel and larger turbines and boilers, although for the next few years he believed that the most attractive possibilities in station design would be along the lines of consolidation of the gains already made. J. A. Keeth reviewed developments that have taken place in the Northeast station of the Kansas City Power & Light Company and said the company contemplated installing a 1,400-lb. boiler, with a 10,000-kw. high-pressure turbine exhausting to the main steam header of the station.

F. S. Collings, of Sargent & Lundy, gave an outline of outstanding points of interest associated with the design of a modern power station in the Middle West; Charles F. Turner of Omaha, E. H. Tenney of St. Louis and K. M. Irwin of Sioux City recited experiences with fuel in their respective companies, and C. S. Tomlinson of the Kansas Gas & Electric Company enlarged upon spray-pond practice and the cost of pumping and outlined current practice and experiences in the burning of oil, gas and coal.

## In the Legislative Mill

### California Legislators Aim More Bills at Utility Companies—Nebraska Power Bill Expands

A RESOLUTION authorizing legislative investigation of newspapers alleged to be subsidized by power companies for the purpose of defeating the Boulder Canyon dam project has been adopted by the California Assembly by a vote of 43 to 26. Another bill, now before the Senate, which holds dangerous potentialities, provides that whenever an increase in rates has been allowed by the Railroad Commission to provide revenue for a specific purpose, and the said revenue has been diverted to other purposes, the Railroad Commission must immediately revoke the increase in rates. Attorneys for the commission declare that there are at present ample laws upon the statute books to enable the commission to enforce its orders.

The bill already reported which puts the state into the superpower business is making progress in the Nebraska Senate, but has been subjected to changes. The first amendment attached widened the limits of the utility district from 43 counties to 92, only one county being excluded so as to avoid a constitutional inhibition against the issuance of bonds by the state. The bill also pledges the credit of the district for the payment of the bonds to the limit of 1½ per cent of the assessed valuation. Another new clause provides that no contract shall be let or bonds issued for any development under the project except following a favorable public vote in the district. Friends of the bill fought all referendums.

The Nebraska Senate has overriden its standing committee and placed on general file the Wilcox bill, which provides maximum electric light rates for cities of from 5,000 to 25,000 population. The bill was attacked as meaning that state control of rates, municipal and private, was being substituted for municipal control. The State League of Municipalities is opposing it on the ground that it opens the way for the swallowing up of small plants by the large companies. For a second time this session the Nebraska House has killed a bill creating a board of examiners for professional engineers. The new bill provided that the board be made up of the state engineer, the state surveyor and the heads of the electrical, mechanical and civil engineering departments of the state university. It was denounced as a scheme to raise fees and fix prices and a reflection on the engineering schools of the country.

Besides the two bills affecting public utility companies in Indiana reported on March 19 (page 622) as signed by the Governor, one other has received his approval. This is a bill to amend the utilities act by omitting from it the proviso which required a report to be made to the Public Service Commission and its approval to be obtained before the earnings of a municipal plant that had accumulated a sinking fund sufficient to pay its debt could be turned into the general fund. Before adjournment the Legislature passed the joint resolution requesting Congress to enact legislation denying jurisdiction to federal courts to hear utility rate cases until the legal remedies offered by the state courts are exhausted.

## Maine Water-Power Legislation in Governor's Hands

The Smith-Wyman bill providing for the exportation of surplus hydro-electric power under the regulation of the Public Utilities Commission passed both branches of the Maine Legislature this week and is now before Governor Brewster. Latest advices indicate that an attempt may be made to revive the Oakes interstate compact bill and that, if this passes, Governor Brewster will probably sign the Smith-Wyman bill as well. The latter passed the House by a vote of 78 to 62 and passed the Senate unanimously.

The bills fostered by the late Senator Carter to strengthen the non-exportation policy of the state have been set aside. The Smith-Wyman bill names a referendum for May, 1928.

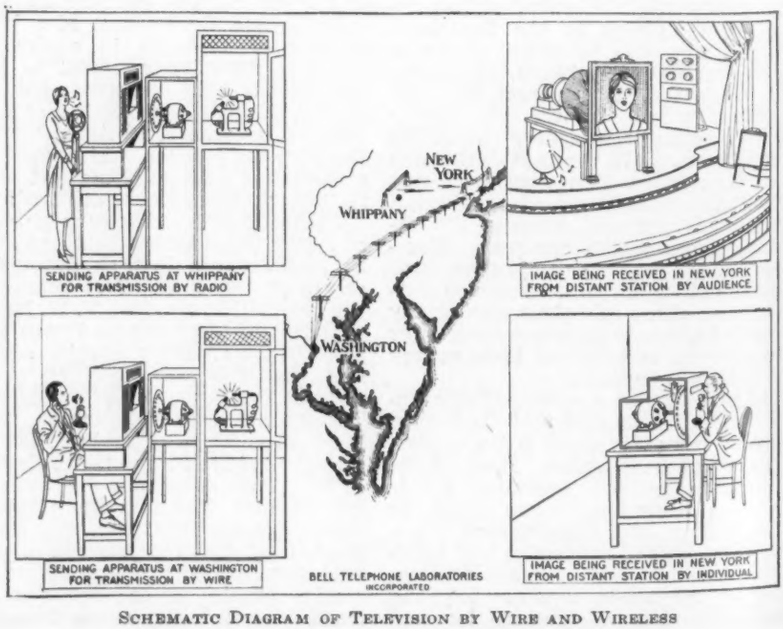
## Television Becomes an Actuality

### Demonstration of Its Practicability Made by American Telephone & Telegraph Company, Speakers at Washington Being Seen in Action on Screen in New York

PRACTICAL demonstration — long awaited—of the new electrical art of television was given publicly for the first time on Thursday, April 7, by the American Telephone & Telegraph Company. On that day the company staged a demonstration divided between Washington and New York. In the former city Secretary of Commerce Hoover, after first conversing briefly by long-distance telephone with President Walter S. Gifford of the telephone company, spoke to a company of seventy specially invited guests of Mr. Gifford's assembled in the auditorium of the Bell Telephone Laboratories on West Street, New York, Mr. Hoover's face being photographed as he talked and the picture transmitted by wire from the political to the commercial capital of the nation. Before this took place, Mr. Gifford and Frank B. Jewett, vice-president of the A. T. & T., had welcomed their guests; Dr. Herbert E. Ives had explained the technology of television, and a demonstration of both the transmitting and the receiving apparatus had been made. The results of the demonstration were considered entirely successful as establishing the feasibility of the invention and foreshadowing its ultimate perfection and commercial employment.

The reproduction on the tiny 2-in. x 3-in. screen immediately confronting Mr. Gifford when he spoke into the telephone at the New York end was, however, admitted to be much better than that on the larger screen, 2 ft. x 3 ft., to which it was transferred. In exact synchronism with the speech of Mr. Hoover as it came from the amplifier were the motion of his lips and his changes of expression as the television apparatus recorded them. With Mr. Hoover in Washington were Vice-president J. J. Carty of the American Telephone & Telegraph Company, A. E. Berry, president Chesapeake & Potomac Telephone Company, and Judge Stephen Davis, solicitor of the Department of Commerce. After Mr. Hoover had spoken, Mr. Carty and others at Washington took his place and conversed one at a time with men in New York, the speaker at the New York end looking the Washington man in the eye as he talked to him. The telephone operator at Washington also appeared intermittently on the screen.

Next it was demonstrated that radio will serve equally with wire as a trans-


NEW YORK
WHIPPANY
WASHINGTON
SENDING APPARATUS AT WHIPPANY FOR TRANSMISSION BY RADIO
IMAGE BEING RECEIVED IN NEW YORK FROM DISTANT STATION BY AUDIENCE
SENDING APPARATUS AT WASHINGTON FOR TRANSMISSION BY WIRE
BELL TELEPHONE LABORATORIES INCORPORATED
IMAGE BEING RECEIVED IN NEW YORK FROM DISTANT STATION BY INDIVIDUAL

SCHEMATIC DIAGRAM OF TELEVISION BY WIRE AND WIRELESS

mitter for the new apparatus, for the group in New York saw and heard a performance reproduced by wireless from the Whippany (N. J.) studio of the American Telephone & Telegraph Company. The program included a description of television by Edward L. Nelson, an electrical engineer with the Bell Telephone Laboratories; a vaudeville act, and a humorous talk in dialect.

### How the Invention Came About

The achievement of an operative system for television is the result of a series of researches and apparatus developments planned by Dr. Ives and conducted by him and by other members of the technical staff of the Bell Telephone Laboratories, among whom the company gives special credit to H. M. Stoller, under whose direction the synchronous motors employed were developed, and Dr. Frank Gray, who devised the method of projecting a minute spot of very bright light upon the object which is to be transmitted and of moving this spot back and forth to illuminate successively the details of the entire area. This light is reflected back upon the photo-electric cell, which generates a current in direct proportion to the amount of light falling upon it. This current, amplified many million million times, is that which is transmitted. Previous experimenters had endeavored to secure complete illumination of the object by pouring a tremendous flood of light upon it. By the use of the new scanning method it is possible to employ, on the average, a very small amount of light instead of an amount which would be unbearable to the actors in the scene. In carrying out this plan, there was constructed, under the direction of Dr. Ives, what is probably the largest photo-electric cell in the world.

The complete process of reproducing in proper order the light details of the scene occupies less than a fifteenth of a second. It is then automatically repeated and thus each detail is instantaneously viewed by the observer fifteen times a second. The beam which assists the photo-electric eye to scan the scene before it is actually a succession of beams. In front of the source of light revolves a disk, the "scanning disk," in which is a series of holes through which darts of light escape to illuminate successively narrow horizontal strips of the scene. This disk is driven by a combination of two electric motors.

Identical motors operate at the receiving station to insure to the flashes of light the orderly succession necessary to recreate the image. At the receiving station there is, first of all, a source of light which responds with a brilliancy corresponding to the current which is received from the transmitting station. The source is a "neon tube." When a high potential is applied to the electrodes there takes place a glow discharge, the brilliancy of which is exactly proportional to the potential. To obtain sufficiently high potential from the distant photo-electric cell there are inserted in the circuit vacuum-tube amplifiers essentially similar to those used in various other operations of telephony.

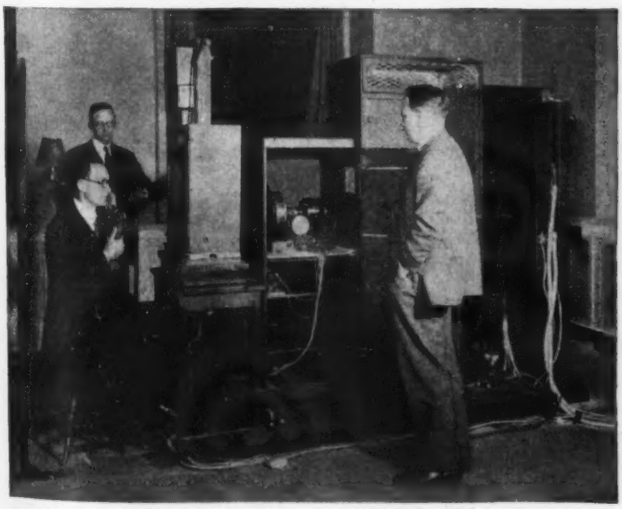
In spite of apparent satisfaction with the results of last week's demonstration, officials of the American Telephone & Telegraph Company do not predict any immediate commercial application of television, the expense of manufacture and installation being at present much too heavy.

The invited guests at the demonstration included, in addition to several eminent physicists and many of the most prominent newspaper proprietors and editors in the country, such well-known electrical and communication executives and engineers as Owen D. Young, Gerard Swope, Guy E. Tripp, E. M. Herr, General James G. Harbord, David Sarnoff, Sosthenes Behn, Hernand Behn, Clarence H. Mackay, John L. Merrill, Newcomb Carlton, James L. McQuarrie, C. C. Chesney, M. I. Pupin, L. B. Stillwell, Gano Dunn, Elmer A. Sperry, W. L. Slichter, Clayton H. Sharp, John W. Lieb and W. H. Onken, Jr.

## Washington's View of Strike of Soft-Coal Miners

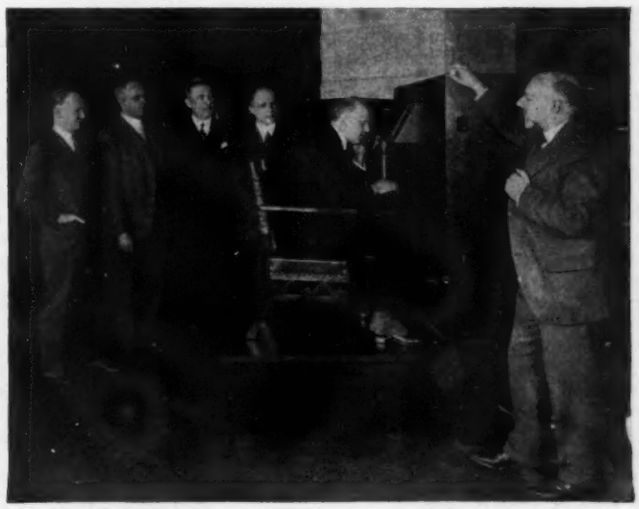
Because of the extraordinary amount of coal in storage observers in Washington expect developments in the strike of bituminous miners in the central field to be slow. The attitude of the strip-pit operators in Indiana and of the highly mechanized mines in Illinois is being watched with most interest. Reports reaching Washington are that these operators are threatening to secede in fear that their claims for consideration will take second place when the scale eventually is negotiated and are convinced that postponement will leave them in a less advantageous position than at present. While the strip-pit operators and the mechanical loading men constitute a small minority of the operators in Indiana and Illinois, it is recognized that the secession of the substantial tonnage which they do produce would influence captive mines and certain other substantial operators to sign the scale, provided a favorable loading scale and certain other concessions could be secured from the miners' union.

While officials are glad that the public is in a position where it will not have to be punished, as a result of the large amount of coal above ground, they recognize as an unsound practice the policy of the railroads in allowing a large addition to storage through the loading of thousands of cars which cannot be billed. With thousands of unbilled cars behind the heavy storage, the tendency of the majority naturally is to think that negotiations should be deferred until stocks have been reduced. As the legal difficulties of non-union operation are less in Pennsylvania and Ohio, expansion of non-union production is expected there. One phase of the situation which pleases Washington is that little pressure can be brought looking to political interference and that the cost of the strike is going to be borne largely by the parties to the quarrel, instead of by the consumers of the fuel.



TRANSMITTING APPARATUS FOR TELEVISION ARRANGED FOR DEMONSTRATION

Seated before the photo-electric cells which act as eyes is R. C. Mathes, and behind him J. W. Horton, both members of the technical staff who contributed importantly to the electrical features of television equipment. On the right, facing a motor of his design, is H. M. Stoller, who was largely responsible for the development of suitable methods of synchronization in television.



PRESIDENT GIFFORD IN FIRST PUBLIC DEMONSTRATION OF TELEVISION

With Mr. Gifford are the following members of the Bell Telephone Laboratories, from left to right: E. P. Clifford, vice-president; H. D. Arnold, director of research; E. B. Craft, executive vice-president; F. B. Jewett, president Bell Telephone Laboratories and vice-president American Telephone & Telegraph Company, and Dr. Herbert E. Ives, member of the technical staff.

## Purchases and Mergers

**Transactions Reported Largely Consummations of Previous Steps Toward Actual Consolidation**

BY A VOTE of 255 to 232 in town meeting the citizens of Milford, Mass., killed a proposal for the purchase by the town of the Milford Electric Light & Power Company, a central station in the Massachusetts Lighting Companies group.

The Union Electric Light & Power Company, Unionville, Conn., which has been authorized to increase its capital stock to $2,000,000, will merge with the New Hartford Electric Company.

The Eastern Connecticut Power Company has been authorized by special act of the General Assembly to absorb the Putnam Light & Power Company, the Danielson Light & Power Company and the Lyme Power Company, control of which it already had.

The Eastern New York Electric & Gas Company, Inc., has made application to the New York Public Service Commission for permission to acquire all of the outstanding capital stock of the Halfmoon Light, Heat & Power Company of Mechanicville, the Salem Light, Heat & Power Company and the Dwass Electric Company of Hudson Falls and for right to merge the three properties into the Eastern New York Company, of which they are now subsidiaries, thus ending their corporate existence. The Plattsburgh Gas & Electric Company has applied for permission to acquire the outstanding capital stock of its subsidiaries, the Champlain Electric Company and the Chasm Power Company of Chateaugay, thereby terminating their corporate existence. All these companies are Associated Gas & Electric concerns.

The New York Public Service Commission has granted the joint petition of the Union Springs Light & Power Company and the Ledyard Lighting Company of Aurora to sell their franchises and plants to the Empire Gas & Electric Company of Geneva, from which they had been buying their electricity. The price to be paid for the Union Springs company is $57,754 and for the Ledyard company $44,371.

The merger of the Sayreville (N. J.) Electric Light & Power Company with the Eastern New Jersey Power Company has been approved by the Board of Public Utility Commissioners.

The Philadelphia Electric Company has applied to the Pennsylvania Public Service Commission for permission to acquire three suburban power companies, incorporated to assist it in carrying out its hydro-electric power project at Conowingo, Md. These are the Plymouth Power Company, the Upper Merion Power Company, and the Whitemarsh Power Company. The purpose is to construct a transmission line from a point of connection with facilities of the Philadelphia Electric Company to a point of connection with a line to Conowingo.

Approval has been given by the Kansas Public Service Commission to the sale of the municipal lighting system at Bern, Kan., to the United Power & Light Corporation, Abilene.

Limon (Col.) taxpayers voted on April 5 to sell the municipal light plant to the Commonwealth Utilities Company of Denver for $92,500, by a majority of 195 to 2.

A. E. Fitkin & Company announced on Wednesday the purchase in behalf of the Inland Power & Light Corporation of the West Missouri Power Company. This property, with the properties of the Trenton (Mo.) Gas & Electric Company, People's Gas & Electric Company of Chillicothe, Mo., and Missouri Electric, Gas & Water Company of Gainesville, Mo., will be merged into the Missouri Public Service Company. (See ELECTRICAL WORLD for Feb. 26, page 472.)

A merger by which eight towns are added to the electrical network radiating from Aberdeen, S. D., and owned by the Northwestern Public Service Company brings under joint ownership local systems in Bristol, Butler, Lily, Bradley, Garden City, Florence, Wallace and Henry. The change in ownership came about through consolidation of the Consumers' Electric Service Company with the Northwestern Public Service Company.

C. P. Couch, vice-president and general manager of the Mississippi Power & Light Company, appeared recently before the aldermen of Oxford, Miss., and arranged for the purchase of the local light plant.

Sale of the Big Lake (Tex.) Utilities Company, of which Dr. A. S. Cochran of Los Angeles, Cal., is the principal stockholder, to the West Texas Utilities Company is announced. The consideration was not made public. The plant will be enlarged and transmission lines built to other towns of this section and to cover the oil field of Reagan County. It is also reported that the electric light and waterworks plants at Yoakum, Tex., have been sold by L. L. Stephenson of San Antonio to the Texas-Louisiana Light & Power Company.

## Activities of Federal Power Commission

The Yosemite Power Company of San Francisco has applied to the Federal Power Commission for a license covering a project on the South and Middle Forks of the Tuolumne River. The plan of development embraces the contruction of two reservoirs of 65,000 acre-ft. capacity, three power houses and the necessary transmission lines and conduits. It is planned to install equipment sufficient to develop 51,000 hp. The application conflicts with one previously submitted by the Turlock Irrigation District.

Applicants to the Federal Power Commission for preliminary permits covering Colbert and Parker Shoals on the Tennessee River below Muscle Shoals have been invited to attend a hearing on the project to be held at the United States Engineers' office at Wilson Dam at 9 a.m. April 19. Conflicting applications have been filed by the Southern Power & Light Company, the Muscle Shoals Hydro-Electric Power Company and the Mississippi Power Company.

The Idaho Power Company of Boise has applied to the commission for a license covering a transmission line connecting its plants at American Falls and at Shoshone Falls. The distance between the power houses is 81¼ miles.

The Buchan & Heinen Packing Company of Seattle has applied to the commission for an amendment to its license which will permit it to increase its storage facilities at Upper Lake in the Tongass National Forest, Alaska.

Mrs. Marian I. Richel of Red Lodge, Mont., has applied for a license covering a small project on the Black Fork of Rock Creek in Carbon County, Mont.

The Excelsior Water & Power Company of California has been authorized by the commission to relinquish its license covering a project on the South Fork of the Yuba River. The irrigation district in that territory has taken over the rights and properties of the company.

The Sierra & San Francisco Power Company of San Francisco has applied for a preliminary permit covering a project at Beardsley Flat on the Middle Fork of the Stanislaus River. The dam proposed will create a reservoir covering 60,000 acre-feet and will regulate the stream flow for the existing Stanislaus plant of the applicant and for the Melones plant now under construction.

A. Frederickson of Snowflake, Ariz., has applied for a preliminary permit covering a small project on Salt River near Globe, Ariz. No action will be taken on this application as it conflicts with the act of the last Congress which divests the Federal Power Commission of authority to grant applications on the Colorado River or its tributaries.

## Water Power in Mexico

**Enterprises Contemplated in Michoacan, Tamaulipas, Chihuahua, Vera Cruz and Other States**

IN A REVIEW of the hydro-electric possibilities of Mexico published in the monthly bulletin of the American Chamber of Commerce of Mexico, George Wythe, acting United States commercial attaché in Mexico City, says that a commission of the Mexican government is now making a survey of the water-power resources of the country with the view of their development on a large scale. Steps already have been taken to harness the waters of the Lerma River, in the northeast corner of the State of Michoacan, about 12 miles from El Oro, a famous mining camp, Mr. Wythe says.

"A masonry dam will be built, and behind it will be stored 500,000,000 cu.m. of water," Mr. Wythe continues. "The preliminary work was completed last August. Instead of going to waste down the channel of the Lerma, at times causing devastating floods, these waters will supply the growing demand for electrical power in Mexico City and its suburbs and, through a comprehensive system of canals to be constructed by the government, irrigate a large territory near Acambaro. The hydro-electric project alone will cost approximately $7,500,000 in American currency. It is expected that the initial installation will comprise two units of 30,000 hp. each. At one point a tunnel nearly 2 miles long will give a head of 200 meters.

A high-tension transmission line will run to El Oro, now the terminus of a power line from Mexico City."

Several large irrigation and hydro-electric projects in northern Mexico will, it is reported, be directed from the Nuevo Laredo office of the J. G. White Engineering Company of New York. This office was established recently with John L. Boardman in charge. A large dam and irrigation system in the State of Tamaulipas, to cost $6,500,000 United States money, will be started immediately, the report says. In addition, preliminary surveys have been made for dams across the Santa Gertrudis, Rio Mante and Juan Capitan Rivers, all in the State of Tamaulipas, and for proposed irrigation systems and hydro-electric plants. A dam will be constructed across the Rio Salado, in Nuevo Leon and Coahuila, for irrigation and power purposes at a cost of $5,000,000.

Work has started on a large irrigation and electric power project on the Santiago River, in the state of Aguas Calientes, to cost approxmately $4,000,000, according to the engineering company. In the State of Durango the construction of dams across the Guatimape, Tunal and Sauceda Rivers is now under way, and there is a similar project on the Lerma River in the State of Guanajuato. In the State of Hidalgo dams are being built across the Endo and Mezquital Rivers.

Of far-reaching importance is the contemplated construction of a dam for the control of the water of Lake Chapala and its use for irrigating 150,000 acres of land and the development of more than 150,000 hp. In the State of Chihuahua dams, irrigation systems and hydro-electric plants are projected for the Conchos and Papagochic Rivers.

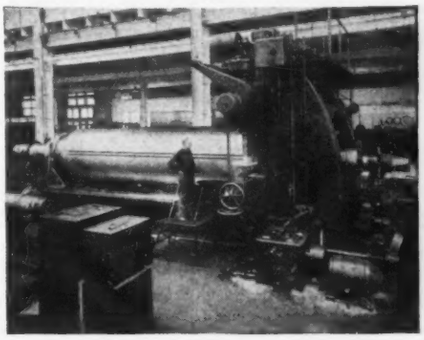
Construction of a reinforced-concrete dam across the Rio Monte, 50 miles from Xicotencatl, State of Vera Cruz, will be started as soon as sub-contracts are awarded, according to Mr. Boardman, who says that all details for the construction of the dam and irrigation system had been arranged with the Mexican government and that the total cost of the project will be approximately $6,000,000. The J. G. White Construction Company has the general contract. In connection with the irrigation project a large hydro-electric plant will be installed.

Surveys for a series of dams and irrigation systems on the Pacific coast of Mexico, between Tepic and Guaymas, ave been completed by R. A. Hill, engineer, and associates, and their report is now in the hands of the Mexican government. The project calls for the construction of dams on the Mayo, Fuerte, Yaqui, Sinaloa and Santiago Rivers, the creating of water-storage reservoirs and the reclaiming of more than 1,500,000 acres of land by means of irrigation. The total cost of the project is estimated at $10,000,000 United States money. The plans also include a series of large hydro-electric plants and of power transmission lines to cities, towns and mining districts in western Mexico. Mr. Hill estimates that it would take about five years to complete the project. An appropriation from the Mexican government is sought.

# Briefer News

**S.E.D. Elects Four New Directors.**—At the annual meeting of the members of the Society for Electrical Development, held in New York recently, the following directors were elected for four-year periods: Charles L. Edgar, representing central-station interests; Howard A. Lewis, representing manufacturing interests; O. Fred Rost, representing jobbing interests, and James R. Strong, representing contracting interests.

**Progress on Southern California Edison's 94,000-Kw. Units.**—Work is progressing steadily on the two 94,000-kw., 1,500-r.p.m. tandem-compound turbo-generators being built by the General Electric Company for the Southern California Edison Company. Each unit consists of a 90,000-kw., 100,000-kva., 16,500-volt main generator, a 4,000-kw. auxiliary generator and the 94,000-kw. tandem-compound turbines. The main generators, the



manufacturer claims, exceed in both capacity and physical dimensions any electric generator previously built, and the turbines are also the largest of the tandem-compound type so far constructed. Each turbo-generator will measure 103 ft. in length and will weigh about 1,650,000 lb. Other unusual features of these machines include provision for future gas-cooling of the generators and the combination of a double-flow low-pressure end with four vertical condensers. They will be the first of their type to generate energy at 16,500 volts. The photograph shows the field of the generator being slotted. Each slot requires eight hours for cutting. Two slots are cut at the same time, on opposite sides of the shaft. The field weighs 208,000 lb. complete.

**Opposition to Toccoa River Dam.**—An injunction to prevent the Toccoa Electric Company from condemning land in Fannin County, Ga., is being sought in the United States District Court by land owners in that county who charge that the proposed dam of the company, which would be 170 ft. in height, would submerge 5,000 acres of land in Fannin and adjoining counties, backing the water up the Toccoa River for a distance of 15 miles, and that the price offered for the property under condemnation proceedings is far too low. It is further charged that the Toccoa Electric Company has been organized by the Tennessee Electric Power Company in order to avoid a Georgia law forbidding foreign concerns from condemning property within the borders of the state.

**Electrical Growth in Southern New Mexico.**—Transmission lines from the new generating plant of the Texas-Louisiana Power Company at Alamogordo have just been completed to Tularosa and La Luz. The plant was constructed at a cost of $300,000, and its formal opening a week or two ago brought forth a statement from A. P. Barrett of Fort Worth, president of the company, to the effect that it plans extensive development in the south-central part of New Mexico.

**Watertown, N. Y., to Vote Next Week on Sale of Surplus Municipal Power.**—The taxpayers of Watertown, N. Y., will on April 19 vote on a proposal to sell the surplus power developed at the municipal power plant to the Northern New York Utilities, Inc., according to a resolution passed by the Common Council. Figured on the basis of the flow of the river in 1925 and 1926, the sale of surplus power will net the city about $100,000, according to information made public.

**American Welding Society Meets April 27.**—The eighth annual meeting of the American Welding Society will be held at the United Engineering Societies Building, New York, on April 27, 28 and 29. The electric arc and gas welding committees will meet on the first morning, and in the afternoon the American Bureau of Welding will hold its session. On Thursday morning and afternoon there are to be symposiums on research activities and production welding respectively, and on Friday afternoon a meeting of the joint-pressure vessel committee.

**Program of Southwestern Division, N. E. L. A.**—Meeting at the Roosevelt Hotel, New Orleans, on April 26-29, the joint convention of the Southwestern Geographical Division of the N.E.L.A. and the Southwestern Public Service Association promises to exceed all previous ones in size and standards. Three presidents of national utility associations are scheduled—R. F. Pack, electric; W. H. Sawyer, railway, and Oscar Fogg, gas. Managing Directors Clapp of the N.E.L.A. and Storrs of the A.E.R.A., E. L. Hinchliff of the Middle West Utilities Company and Charles B. Scott of the Public Safety Bureau, Chicago, are other speakers promised.

**Dominion May Set up a Federal Hydro-Electric Commission.**—As a consequence of the Ottawa River power tangle there is a possibility that a federal hydro-electric commission will be constituted by the Dominion government for the purpose of exploiting the power on the Ottawa River, including the Carillon site. It is contended that the Canadian government could acquire the claims of Ontario and

Quebec by selling half the power to the Ontario Hydro-Electric Commission and the other half to any interests in Quebec that might desire it. A hint of this was dropped in the course of a recent debate in the House of Commons at Ottawa by the Minister of National Revenue.

**Interconnection in Ottawa River Territory.**—Directors of the Ottawa-Montreal Power Company have authorized the building of a high-tension line from Calumet to Hull, Quebec, to connect with the Ottawa & Hull and Ottawa River power systems. When the new transmission line is completed the Ottawa-Montreal company will operate from Ste. Anne de Bellevue, at the confluence of the Ottawa River with the St. Lawrence, to Hull.

**Tecumseh (Kan.) Plant to Burn Gas.** — Contracts have been completed which will result in the utilization of natural gas as fuel at the Tecumseh plant, chief generating unit of the Kansas Power & Light Company, Topeka, it is announced by A. M. Patten, vice-president and general manager. Since several hundred Topeka homes use natural gas in furnaces for house heating, the Tecumseh plant will not depend on gas in midwinter, but will use it for the remaining months of the year. Work on the installation of a new 22,500-hp. turbine at Tecumseh will be completed July 1, the company predicts. Later in the year work will begin on a high-tension transmission line to Manhattan, connecting with the lines of the United Power & Light Corporation. Manhattan is 60 miles west of Tecumseh.

**New Plants for the Menominee River.** —Two more hydro-electric plants will probably be added during 1927 to the large number now in operation on the Menominee River in Wisconsin. The first of these, that of the Northern Electric Company at Chalk Hills, is scheduled for completion by May 1. Construction crews will then move five miles down the river to complete work on the White Rapids dam and power plant, on which building operations were started last fall but had to be abandoned owing to unfavorable weather conditions. The company, which is owned by the Northern Paper Mills Company, Green Bay, will transmit energy for paper-mill use. Energy in excess of these requirements has been contracted for by the North American interests. A summer resort region will be formed around the reservoirs when the power dams are completed.

**Salt River Valley Water Users Expanding Electric Service.**—The hydro-electric system of the Salt River Valley Water Users' Association in Arizona is productive of large profit, according to C. C. Cragin, manager of the system, who says that while seven years ago the gross revenue from power sales was only $30,000 for the year, in 1926 it had increased to $1,147,000 and that the revenue for 1927 will range between $1,600,000 and $2,000,000. About 12,000 hp. will be added by a new dam at Stewart Canyon, between Mormon Flat and the junction of the Salt and Verde Rivers. It is proposed to transmit electricity to every farm included in the territory of the project. In the last six years the association has collected from its membership $4,770,000 for water service and all assessments and has expended about $8,200,000 for capital improvements. The gross investment is more than $20,000,000.

**Chicago Drainage Canal and International River Power.**—Two motions by the State of Illinois and the Chicago Sanitary District were filed last Monday in the United States Supreme Court in the action brought by New York State against diversion of water from Lake Michigan. Illinois declared that no showing had been made that the diversion would have any effect upon development of water power from the Niagara and St. Lawrence Rivers and, moreover, that New York's right in these international streams was "purely speculative, conjectural and hypothetical." Special Master Charles E. Hughes, who has the hearings in charge, was therefore besought to strike from the complaint all references to New York's assumed stake in water power.

## Coming Meetings of Electrical and Allied Societies

American Institute of Electrical Engineers — Middle Eastern District, Bethlehem, Pa., April 21-23; Northeast District, Pittsfield, Mass., May 25-27; summer convention, Detroit, June 20-24. F. L. Hutchinson, 36 West 39th St., New York.

Southeastern Water and Light Association—Jackson, Miss., April 26-28. W. F. Steiglitz, Columbia, S. C.

Southwestern Division, N.E.L.A.—New Orleans, April 26-29. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Southwestern Public Service Association — New Orleans, April 26-29. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

American Welding Society—United Engineering Societies Building, New York, April 27-29. M. M. Kelly, 33 West 39th St., New York.

Nebraska Section, N.E.L.A.—Grand Island, Neb., April 27-28. H. M. Davis, 1519 O St., Lincoln.

American Electrochemical Society — Benjamin Franklin Hotel, Philadelphia, April 28-30. Colin G. Fink, Columbia University, New York.

Electrical Supply Jobbers' Association —Greenbrier Hotel, White Sulphur Springs, W. Va., May 4-6. Franklin Overbagh, 411 South Clinton Street, Chicago.

Missouri Association of Public Utilities —Cape Girardeau, May 5-7. F. D. Beardslee, 315 North 12th St., St. Louis.

Arkansas Utilities Association—Hot Springs, Ark., May 16-18. R. I. Brown, Arkansas Central Power Co., Little Rock.

Middle West Division, N.E.L.A. — Topeka, Kan., May 18-20. H. M. Davis, 1519 O St., Lincoln, Neb.

American Society of Mechanical Engineers—White Sulphur Springs, W. Va., May 23-26. C. W. Rice, 29 West 39th St., New York.

Canadian Electrical Association—Clifton Hotel, Niagara Falls, Ont., May 25-27. J. B. Woodyatt, Southern Canada Power Company, Montreal.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., May 28-June 4. S. N. Clarkson, 30 East 42d St., New York.

American Association of Engineers—Tulsa, Okla., June 6-8. M. E. McIver, 63 East Adams St., Chicago.

National Electric Light Association—Atlantic City, N. J., June 6-10. Paul S. Clapp, 29 West 39th St., New York.

Pacific Coast Electrical Association—Santa Cruz, Cal., June 14-18. S. H. Taylor, 447 Sutter St., San Francisco.

North Central Division, N.E.L.A.—Lake Superior steamboats from Duluth, June 17-20. J. W. Lapham, 351 Loeb Arcade, Minneapolis.

Northwest Electric Light and Power Association—Salt Lake City, June 21-24. C. W. Lundquist, Utah Power & Light Co., Salt Lake City.

**New Haven Company to Build New Unit.**—The United Illuminating Company of New Haven, Conn., will begin this spring the construction of an additional power house on its present property to house about 32,500 kw. in new equipment and cost approximately $3,250,000. It is understood that three turbo-generator units will be installed, but their individual ratings have not yet been determined. Work will begin this spring, and the new station will be completed in the fall of 1928. It is to be called the English station in honor of James English, president of the company.

**Roseate Prophecies for Railroad Electrification at Philadelphia.** — Despite some published denials by Baltimore & Ohio Railroad officials, plans for the electrification of that railroad's Philadelphia terminal in connection with the erection of a new and ornate station building are believed by Philadelphia newspapers to be under way. This belief is predicated on interviews known to have been held between the Mayor and President Daniel Willard and other B. & O. officials and a statement from the Mayor that co-operation between the city and the railroad is in prospect. Some prophets include the Philadelphia & Reading in the mooted arrangement and predict that electrification of the city lines of both these railroads as well as of the Pennsylvania will be completed within a few years.

**Private St. Lawrence Canal Project with Big Power Feature Seeks Canadian Charter.**—A bill has been introduced in the Canadian House of Commons to incorporate the Great Lakes & Atlantic Canal & Power Company. This company seeks to build a deep-waterway canal from Cornwall, Ontario, to Montreal in the interprovincial section of the St. Lawrence River, to construct a viaduct or vehicular traffic bridge over the river near Valleyfield, and to generate, distribute and sell such electrical energy as may become available by the construction of the canal. Estimates of the energy that could be developed along the route range from 600,000 hp. to 3,000,000 hp., and in this section of the river there are already several large private developments of power, made by Montreal Cottons, the Montreal Light, Heat & Power Company and other Montreal firms. Between Lake St. Francis and Lake St. Louis, where one of the company's proposed large developments would be, there is a total drop in the river of 80 ft., and between Lake St. Louis and Montreal, through the Lachine Rapids, there is a further drop of 45 ft.

# Men of the Industry

## A. B. Lisle Receives Promotion

Arthur B. Lisle, who was elected a vice-president of the Narragansett Electric Lighting Company, Providence, R. I., as was announced in the April 2 issue of the ELECTRICAL WORLD, has been affiliated with the Narragansett company almost continuously since 1893 and has served in the capacity of general manager ever since 1908. As vice-president Mr. Lisle will have jurisdiction over the treasurer's office and taxation matters, also assisting the president in public relations work. In this field of public relations Mr. Lisle has already gained a reputation for success, for it has been under his management, with the co-operation of his

A. B. LISLE

associates, that the company has made striking progress in the development of the customer-ownership plan.

In addition to his executive position with the Narragansett Electric Lighting Company Mr. Lisle occupies the presidency of the Providence Steam Company and serves on the directorate of the Bristol County Gas & Electric Company, Mystic Power Company, South County Public Service Company, Seekonk Electric Company as well as that of the Narragansett company. In 1924 Mr. Lisle was named Rhode Island chairman of the New England joint committee of thirty appointed to investigate and report on the proposed St. Lawrence River navigation and power project. He has always taken an active interest in the affairs of the New England Division of the National Electric Light Association, having served as president of that division and as chairman of its Public Relations Section.

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**Samuel P. Williams**, secretary of the Hart & Hegeman Manufacturing Company, Hartford, Conn., for the last five years, was elected president and treasurer of the company to succeed the late Shiras Morris at the recent annual meeting of the directors in the Hartford Club. The new president has been connected with the Hart & Hegeman Manufacturing Company for eight and one-half years and is a director of the company. He is also a trustee of the United States Security Trust Company and a director of the Williams & Carleton Company. Mr. Williams was born in Hartford in 1874 and was graduated from the Sheffield Scientific School at Yale University in 1894. After graduation he entered the Williams & Carleton Company and remained with that company for 24 years. He then joined the Hart & Hegeman Company.

**George E. Whitwell** has been appointed general sales manager in charge of the general sales department recently formed to include that of the Duquesne Light Company, the Equitable Gas Company and the Equitable Sales Company.

**Herman K. Stein**, formerly superintendent of the Western New York Utilities Company, Batavia, N. Y., is now general manager of that utility. The Western New York Utilities organization was recently taken over by the Buffalo, Niagara & Eastern Power Corporation.

**Colonel Hugh L. Cooper**, under whose direction the Wilson Dam at Muscle Shoals was built, sailed for Europe April 9 aboard the United States liner *Leviathan*. Mr. Cooper's objective is Russia, where he is to begin work on the soviet government's seventy-million-dollar hydro-electric project on the Dnieper River.

**Percy J. Wilson** has been appointed general sales manager of the Narragansett Electric Lighting Company, Providence, R. I. Mr. Wilson has been connected with the Lowell (Mass.) Electric Light Corporation since 1907 and is one of the best-known engineers in the New England power sales field. He is a past-chairman of the Commercial Section of the New England Division of the National Electric Light Association and has served with distinction as chairman of the Power Bureau of this geographic section.

**Chester A. Corney**, who has been affiliated with the electrical engineering department of the Edison Electric Illuminating Company of Boston since the summer of 1922, has been appointed assistant superintendent of that department. Early in his career he was associated with Stone & Weber, engaging in construction work in connection with the building of several new substations for the Boston Elevated Railway Company, later being transferred to the Boston office to do some drafting and designing. From 1916 to 1922 he spent in the electrical engineering department, devoting his attention to engineering and design work for numerous electric light and power systems in various parts of the country. Mr. Corney entered the employ of the Edison company in August, 1922, as an engineer in the engineering division of the electrical engineering department and in February, 1923, was appointed to head this division. He is a member of the A.I.E.E. and takes an active interest in its various committees and those of the N.E.L.A. **John F. Maxwell** has been appointed head of the engineering division of the electrical engineering department to succeed Mr. Corney.

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## Nicholas Stahl Leaves Providence for Chicago

Nicholas Stahl has resigned his position as superintendent of generation of the Narragansett Electric Lighting Company of Providence, R. I., and on May 1 he will assume the duties of vice-president in charge of operation of the United Public Service Company, with headquarters at 100 West Monroe Street, Chicago. The United Public Service Company is a new holding company operating electric, gas and ice plants in Ohio, Indiana, Illinois, Tennessee, Mississippi, Louisiana, Texas, Arkansas, North Dakota and South Dakota.

Mr. Stahl is well known in engineering circles in New England. He affiliated himself with the Narragansett company in December, 1918, following a connection with the power department of the Westinghouse Electric & Manufacturing Company. His first position at Providence was that of general engineer, in which capacity he succeeded Martin W. Kern. Mr. Stahl is a fellow of the American Institute of Electrical Engineers.

NICHOLAS STAHL

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## Utility Executives Head Civic Campaigns

Three Oklahoma public utility executives within recent weeks have had the honor of leading successful fund-raising campaigns for the benefit of business or educational institutions in their communities. **J. F. Owens**, vice-president and general manager of the Oklahoma Gas & Electric Company, brought to a successful termination a campaign to raise $500,000 in Oklahoma City to serve as an endowment fund for Oklahoma City University. Mr. Owens was chairman of the campaign, and he was assisted by several hundred workers, including a large number of public utility men. **Fred W. Insull**, president of the Public Service Company of Oklahoma, served as general chairman of the membership campaign of the Tulsa Chamber of Commerce, which resulted in adding more than 450 new members to the club and raising more than $125,000 for its work during the coming

twelve months. **W. R. Emerson**, secretary-treasurer of the Oklahoma Gas & Electric Company, headed a successful membership and industrial expansion drive for the Oklahoma City Chamber of Commerce, in which $133,000 was raised.

### George J. Carney Joins "Electrical World" Staff

George J. Carney, who has been assistant to the director of the Wisconsin Public Utilities Bureau since 1920, became an assistant editor of the ELECTRICAL WORLD on April 1. His headquarters will be in Chicago for the present, and his editorial duties will involve general editorial assistance to F. R. Innes, the Western editor of the ELECTRICAL WORLD. For the past six years Mr. Carney has been engaged in utility information bureau work in Wisconsin and has served as correspondent for the ELECTRICAL WORLD and other McGraw-Hill magazines. He has a wide acquaintance with utility men and utility conditions in the Chicago territory.

Mr. Carney was born in Milwaukee in 1898 and after completing his education served in the World War and participated in all the major engagements of the American forces. Business experience with the Pathé Exchange, Inc., and general newspaper work preceded his connection with the Wisconsin Public Utility Bureau.

**C. C. Herrmann** has resigned as assistant treasurer of the Middle West Utilities Company, Chicago, to become treasurer of the Central & South West Utilities Company, a subsidiary of the Middle West Utilities Company.

**Ernest T. Craig**, for the past six years manager of the Leominster (Mass.) Electric Light & Power Company, has resigned to join the staff of the Public Utilities Finance & Accounting Company, Boston. **Fred F. Johnson**, superintendent of outside construction, has been appointed manager.

**Archibald Page**, vice-president of the British Institution of Electrical Engineers, has been appointed chief engineer and manager of the recently formed Central Electricity Board of the United Kingdom. Mr. Page has been closely associated with the electrical industry in Great Britain for the past 28 years, having been for some years manager of the Clyde Valley Power Company. From its inauguration until 1925 he was a member of the British Electricity Commission, a position he resigned in order to become a director and general manager of the County of London Electric Supply Company, Ltd.

**A. C. Schultz**, who has been with the Wisconsin Inspection Bureau for twelve years as electrical engineer and inspector, will sever his connection with that organization May 1, to enter the electrical engineering and contracting field under the name of Schultz & Fuhr, Inc. He has been a member of the Milwaukee Electrical Examining Commission of the Department of Building Inspection under William D. Harper for the past seven years and has acted in the capacity of chairman of that commission for three years. Prior to his association with the bureau he was electrical inspector for the Milwaukee Board of Fire Underwriters and served also as resident engineer for the Underwriters' Laboratories, Inc.

## Obituary

### Albert M. Lynn

Albert M. Lynn, president of the West Penn Electric Company and a director of the American Water Works & Electric Company, died at the Roosevelt Hospital, New York City, April 8 after a long illness. Mr. Lynn was 52 years of age. For more than thirty years he had been identified in important executive capacities with the public utility properties of the American Water Works & Electric Company.

Mr. Lynn was born in Indianapolis, but at an early age removed to Pittsburgh, where he attended public schools. On Feb. 1, 1893, he entered the employ of the American Water Works & Guarantee Company, the predecessor of the American Water Works & Electric Company, serving for some years in the general offices at Pittsburgh. He then became manager of the company's waterworks plant at Chattanooga, Tenn., and later of that at Birmingham. For many years thereafter he was in charge of a large proportion of the company's waterworks properties.

A. M. LYNN

In 1917 he was elected president of the West Penn Company, and upon the organization of the West Penn Electric Company he became its president, in which capacity he was serving at the time of his death. Among his associates and throughout the large territory served by the properties of which he was the head Mr. Lynn was noted for the great energy and attention which he devoted to his work. His experience with and knowledge of the public utility properties of the American Water Works & Electric Company made his advice and counsel of great and increasing value. His personality was engaging, and his kindly and sympathetic nature strongly impressed itself upon the personnel of the various organizations and upon a wide circle of friends, within and without the industry.

**Joseph N. Losey**, formerly chief engineer of the Hornell (N. Y.) Electric Company, died after a lingering illness at his home in that city April 6. Mr. Losey had for many years held with the New York Central Electric Corporation a post similar to the one he held with the Hornell Electric Company. He was 56 years of age.

**Leon P. Feustman**, formerly vice-president of the Worthington Pump & Machinery Corporation in charge of general commercial affairs, and executive and director of many other corporations, died at his home in New York April 7. Last October Mr. Feustman resigned from the Worthington organization after an association which dated back to 1903. Previously he was closely connected for many years with some of the most important Guggenheim enterprises. He was a native of Philadelphia and a graduate of the University of Pennsylvania.

**Thomas D. Lockwood**, an inventor and consulting patent attorney of the American Telephone & Telegraph Company, died at his home in Melrose, Mass., April 5. Mr. Lockwood had been in the employ of the American Telephone & Telegraph Company and its predecessors since 1879 when he retired eight years ago as general patent attorney. Since that time he had served the company as consulting patent attorney. Mr. Lockwood was the inventor of several electrical devices and was the author of several books on electrical subjects. He was a member of the Institution of Electrical Engineers (British) and a life fellow of the American Institute of Electrical Engineers.

**Elmer J. West**, a vice-president of the Adirondack Power & Light Corporation, Schenectady, N. Y., died at his home in Glens Falls, Feb. 27 in his seventy-first year. As early as 1898 Mr. West was interested in electrical projects, and the important part he took in hydro-electric development, especially at Spier Falls, marked him a pioneer in that field. He was well known throughout the Mohawk Valley and was recognized in that region as one of the most valuable contributors to the growth of the system which today includes the Adirondack Power & Light Corporation. Born at Fort Ann, N. Y., he moved with his people at an early age to Glens Falls, where he resided up to the time of his death and where he was prominently associated with every movement for the betterment of the city.

**George B. Rubens**, vice-president of the Indianapolis Light & Heat Company and an active participator in the business affairs of Indianapolis for more than 35 years, died recently at his home in that city. During the first part of his business career he was connected with various mercantile enterprises, but sixteen years ago he affiliated himself with the Indianapolis utility. He was a native of Chicago and was 57 years of age.

**John Lammey Stewart**, educator and a member of the Public Service Commission of the Commonwealth of Pennsylvania, died suddenly April 12 in his sixtieth year. Following graduation from the University of Pennsylvania, Mr. Stewart joined the teaching staff of Lehigh University, where he remained for 26 years, until his appointment to the Public Service Commission in 1923.

# Recent Court Decisions

**Electric Power Company's Duty to Inspect New Poles to Insure Safety of Linemen.**—Sustaining a verdict for the plaintiff in Burgess vs. North Carolina Electrical Power Company, a suit asking damages for the death of a lineman who fell from a new pole on the company's line because, as alleged, the wood was too soft to hold his "climbers," the Supreme Court of North Carolina said an employer's want of knowledge of a defect in such property does not relieve him from responsibility for the results of an ensuing accident. Whether the foreman's inspection of the pole had been efficient and whether the victim was contributorily negligent or assumed the risk of falling were questions properly left to the jury. (136 N.E. 711.)*

**Riparian Owner May Erect Non-Obstructive Dam in Navigable Stream Pending State Plan.** — In People vs. New York & Ontario Power Company the Appellate Division of the New York Supreme Court held that while all grants in navigable waters may be recaptured by the state when it determines to improve the stream for navigation, a riparian owner holding title from the state to the bed of a navigable stream may construct a dam and impound water and turn it into a canal for power purposes if he does not thereby obstruct navigation, or the state may grant permission to construct a dam for like purposes; but all rights of riparian owners, except under grant by Legislature for a purpose beneficial to commerce, are subject to the paramount right of the state to improve the stream. The riparian owner of a dam in a navigable stream which is not an obstruction to navigation will be permitted to continue the maintenance of the dam for power purposes until the state adopts a plan for developing the stream and will not be ejected in an action by the state prior to adoption of such a plan. (219 N. Y. S. 497.)

**Right of Company to Maintain Transformers on Posts Where Necessary.**—In Cooperstone vs. Brooklyn Edison Company suit was brought to enjoin the company from maintaining a transformer upon 14-ft. posts in the sidewalk, opposite and 15 ft. from plaintiff's property, surface water making it impracticable to place them underground at the location in question. In refusing the petition the Kings County Supreme Court said: "If defendant was using these transformers to furnish street lights in the vicinity of them, there could not have been any complaint. The plaintiff does not own the fee of the street—that is in the city—and as defendant has all the official authorization required by law for the erection of the transformers, they could be maintained unquestionably, if used for a street purpose. While it is conceded that no street lights are now being furnished by means of these transformers, the defendant has the contract to light the streets in the vicinity with others, and the proof shows it contemplates making such use of these converters before long. Plaintiff could be denied relief for that reason. But there is no basis for a recovery by plaintiff, even if street lights are never to be furnished through these transformers. The proof does not warrant a finding that plaintiff has suffered any damage by their erection. True, they do not add anything of beauty to the view; but they are so placed as not to obstruct in any real sense access to the property or interfere with the light and air. A witness claiming to be qualified to speak as an expert did say there had been a large depreciation in rental value because of the transformers, but the court cannot credit his testimony, even though it be undisputed. As plaintiff is not damaged and is only an abutting owner, he has no cause of action." (219 N.Y.S. 11.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

**Crop Shortage Not Reason for Invalidating Contract to Take Minimum Power in Cottonseed Mill.**—The United States District Court for the Eastern District of South Carolina has affirmed judgment for the plaintiff in a suit brought by the Columbia Railway, Gas & Electric Company against Swift & Company, owners of a cottonseed mill which had contracted to purchase a minimum amount of power unless it was prevented from doing so by strikes, fire, flood "or any cause" reasonably beyond its control. The industrial company held that a shortage in the cotton crop came under the meaning of the qualifying provision and that it should be exempt from the minimum payment, but the court held that the crop shortage was not the proximate, but only a remote, cause of the stoppage of the mill, since sufficient seed was produced in the mill's territory to have kept it running had the owners received a large part of it. The court further ruled, on another point in dispute, that even if an increase in rate by the electric company was unauthorized, a customer who pays it voluntarily cannot recover the excess. (17 Fed. (2d) 46.)

**Individual Rights Must Yield to Demand of Public.**—Denying to the East Hampton (Long Island) Electric Light Company the authority to acquire a right-of-way across the lands of the Long Island State Park, a justice of the Supreme Court of New York in Kings County said, after citing the positive prohibitions of the law of 1924 establishing the park and vesting its control in the Long Island Park Commission: "The present Governor has appointed the above commission, and the powers conferred upon it under the low are most sweeping and, in a way, the most drastic of any to which my attention has ever been directed. In view of the powerful provisions of this law and the broad prerogatives assumed by the members of this commission thereunder, I cannot see how I can grant the relief prayed for. With this law in its present shape upon the statute books of our state, the individual must bow before the activities of this commission in its plans for park development. The individual yields to the demand of the public. As I view the situation, the State of New York, under the acts of the commission, claims title in the state to the property in question. The petitioner, therefore, is relegated to the provisions of this law, under which it may make humble application to the commission for a license or an easement for the public purpose sought herein, to extend its plant so as to serve the Montauk Point end of Long Island."

# Commission Rulings

**Minimum Rate Approved.**—Replying to protests against its approval of a minimum charge for gas by the Public Service Electric & Gas Company, the New Jersey Board of Public Utility Commissioners said: "The company cannot be denied a rate which will compensate it for all operating costs and afford a reasonable return on the value of its property. It is evident that if a meter is installed and no gas is used, or the quantity is so small that payment therefor does not pay the costs incurred for the particular customer, the loss must be made up by the revenue obtained from other customers of the company. While in any one year this might be absorbed and not affect the rate structure, it is apparent that many customers carried at a loss over a term of years would either result in an increase in the unit price for gas or prevent a reduction in rates. In either event the customers who had been paying their shares of the costs of operation would lose an advantage to which they would be entitled."

**Why Seasonal or Standby Service Is Entitled to Special Rates.**—The city of Cedarburg, Wis., has been authorized by the Wisconsin Railroad Commission to establish special rates for seasonal and standby electric service. In making this decision the commission pointed out that in order to justify certain rates for different classes of service the particular service receiving such rate must have some peculiar characteristics such as excellent load factor, operation at off peak or the like. The seasonal service power customer, the commission said, is usually one having a heavy demand for a few months, thus requiring a considerable investment in transformers, lightning protection, meters, etc., to supply his special service, on which the fixed cost incurred during a considerable portion of the year, when not in use by him, must either be carried by him or loaded upon the full twelve-month users. A customer desiring auxiliary or breakdown service gives to the utility only such business as he cannot or does not find it convenient to supply himself, and the utility is obliged to install a considerable plant in order to supplement during a few hours the private plant of the customer.

# Financial and Statistical

### Common Stocks Move Upward Curb Issues Are Active Bond Strength Is Maintained

GOSSIP in the street shows a disposition to anticipate greater interest in utility stocks as a group during the next few weeks. Every time there is a temporary lull or a reaction in the industrials and rails, certain of the leaders among the utilities come in for heavier trading, and the progress that has been made recently has been made more or less by spurts. The volume of trading in these stocks seems to have accelerated since the publication of the Federal Trade Commission's report on the power industry, the expectation of which was a factor of more or less uncertainty.

More common stocks recorded advances in the various markets this week than for some time. Notable examples are American Gas & Electric, American Water Works & Electric, Columbia Gas & Electric, Public Service of New Jersey and Electric Investors. Several others have shown marginal advances.

Keen interest is also being shown in the preferred issues of power and light companies. Substantial gains have been made in the last week or two and the market is particularly firm at the moment. Important gains have been made in such issues as Kansas Gas & Electric, Utah Power & Light and Nassau & Suffolk Lighting.

Various indicators point to the strengthening of the bond market. While not directly in the power and light field, the sale of a 4½ per cent issue by the Cincinnati Street Railway this week is an item of significance in relation to the whole bond market. The largest bond issue of the year came this week in the Duquesne Light financing. A feature of this issue, as reflecting on the bond situation, is that the issue enables the company to place its entire funded debt on a lower interest basis than now prevails on any part of it.

## New Capital Issues

The largest offering of the year was made on Wednesday, April 13, when the Duquesne Light Company issued first mortgage 4½ per cent gold bonds to the amount of $55,000,000, the price being 95 and accrued interest, to yield 4.78 per cent. The Southwest Power Company issued first mortgage 5 per cent gold bonds, totaling $4,080,000, priced at 96 and accrued interest, to yield over 5.25 per cent.

First lien 6 per cent gold bonds, series A, of the United Public Utilities Company were offered during the week ended April 14 to the amount of $5,550,000 and were priced at 100 and interest, yielding 6 per cent.

The Long Island Lighting Company issued 5½ per cent gold debentures, series A, at 100 and interest, a piece of financing involving a total of $1,500,000. These debentures, will be convertible into the company's 6 per cent cumulative preferred stock, $100 par value, at the rate of one share of preferred stock for each one-hundred-dollar principal amount of debentures.

To raise funds for the acquisition of properties and for general corporate purposes, the Electric Public Service Company issued first lien collateral 5½ per cent gold bonds, series C, amounting to $1,400,000, the price being 95 and interest to yield over 6 per cent. These bonds were dated April 1, 1927, and mature April 1, 1942.

The Spruce Falls Power & Paper Company, Ltd., offered first mortgage 5½ per cent serial gold bonds to the amount of $13,000,000, the price being 100 and interest.

A foreign loan appeared among the week's flotations—the three-million-dollar offering of the Tyrol Hydro-Electric Power Company in the form of 7 per cent guaranteed secured mortgage twenty-five-year sinking-fund gold bonds.

The Queens Borough Gas & Electric Company issued 5½ per cent convertible gold debentures, series A, to the amount of $4,000,000, the price being 100 and interest.

## Boston Edison Gains in Gross and Net

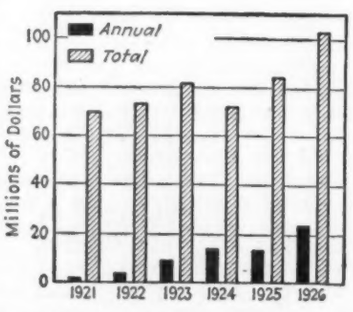
### New Records Attained in Sales and Outputs—Both Wholesale and Retail Business Growing Rapidly—Customers Multiplying

STEADY expansion of earnings, better control of expenses, reflected in a relatively smaller increase in operating costs, and increased diversity of business are features of the development of the Edison Electric Illuminating Company of Boston for the calendar year 1926. Gross operating revenues totaled $23,204,901, against $21,315,241 for 1925, a gain of 8.86 per cent. Net operating revenue for 1926 was $13,413,413, compared with $11,474,363, an increase of 16.9 per cent. Net available for depreciation reserve and surplus, after the payment of $5,605,692 in dividends, was $7,772,253 in 1926, against $6,704,436 in 1925, or a gain of 15.9 per cent. There was available for depreciation reserve and surplus $2,166,561 in 1926, compared with $1,098,744 in 1925, and the total amount transferred from profit and loss to depreciation reserve in 1926 was $2,300,000, compared with $1,300,000 a year ago, or an increase of $1,000,000.

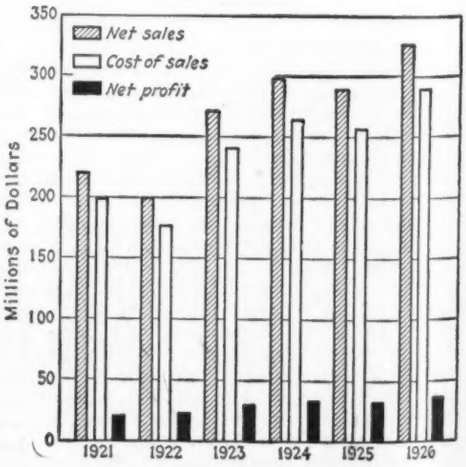
Dividends have been paid continuously by this company since January, 1887, and the present rate of 12 per cent has been paid since August, 1910. The outstanding capital stock on Jan. 1, 1927, totaled 467,141 shares at $100 par. With the premiums, now totaling $28,914,634, these shares represent an issue value of $75,628,734, or $162 each. There are no outstanding bonds, but on Jan. 1 1925 and 1926 notes totaling $30,000,000 were outstanding (due 1928). The total debt was $44,035,000 at the beginning of 1927 and $36,005,000 at the start of 1926. Total assets

RATIOS AND PERCENTAGES, BOSTON EDISON COMPANY

| | 1926 | 1925 |
|---|---|---|
| Gross revenue to capitalization (including premium) | 1 to 3.26 | 1 to 3.54 |
| Total debt to gross revenue | 1 to 1.9 | 1 to 1.69 |
| Investment to capitalization | 1 to 1.6 | 1 to 1.51 |
| Investment to gross revenue | 5.2 to 1 | 5.35 to 1 |
| Gross revenue to operating expenses | 2.37 to 1 | 2.16 to 1 |
| Total assets to revenue | 5.5 to 1 | 5.6 to 1 |
| Net earnings to revenue | 1 to 1.73 | 1 to 1.86 |
| Per cent of total debt to book value | 36.4 | 31.6 |




GROWTH IN ACCUMULATION OF SURPLUS




BUSINESS GROWTH HAS BEEN STEADY OVER LONG PERIOD

were respectively $127,501,644 and $119,068,333.

The total energy sold in 1926 was 543,487,896 kw.-hr., compared with 500,169,774 kw.-hr. in 1925, or a gain of 8.65 per cent. Excluding energy sold the New England Power Company, the totals were respectively 539,470,896 kw.-hr. and 474,397,774 kw.-hr. The peak load was less in 1926, being 190,276 kw. against 203,199 kw. in 1925. The company operates three stations with a total rating of 271,150 kw., and the system load factor increased from 35.3 per cent in 1925 to 41.23 per cent in 1926. The fuel economy of the system increased 8.3 per cent during the year, and the coal rate for 1926 was 1.357 lb. per kilowatt-hour net generated energy.

# Depreciation Theories Differ Widely

## "Condition per Cent" and Application of the Annuity Principle Examined—Regulation Not Likely to Become Standardized

By James D. Mortimer

NO MATTER how much we may oppose the idea of "accrued depreciation" or "value new less depreciation," the question will be met from time to time until the courts and commissions evolve some theory of value that eliminates it. Naturally enough, "life tables" are rejected because they seem to be meaningless. We prefer inspection and the judgment of those experienced, etc. The best the experienced person can do is to estimate the future life in service of the particular unit after making provision to put it in good condition if such be needed. Let us assume that we are trying to measure the ratio of future service value to original service value. Then there arise the questions:

(a) Shall service values be considered proportional to units of service?

(b) Shall the service units developed each year be summed up arithmetically or geometrically?

(c) Shall it be assumed that the units of service be equally distributed over equal increments of time, or

(d) Shall the units of service be distributed at an increasing or declining rate over equal increments of time?

(e) In determining units of future service, shall they be constructive and (or) affirmative; and if both, shall they have equal weight in the same year?

(f) In determining the present value of units of future service, shall there be any allowance for decline in efficiency relative to units of service that could be derived from a new competitive mechanism or structure?

Usually, relative service values are considered proportional to units of service equally distributed over equal increments of time. Here ratio of an arithmetical sum of the future units of service to the arithmetical sum of the total units of service is frequently used to measure the "condition per cent."

In Wisconsin the geometric sum has been used at times under the name "4 per cent sinking-fund curve." This was apparently derived by Spence, and the justification for its use was a belief that mechanisms and structures "depreciated" slowly at first and then at an increasing rate until minimum service value was reached; this curve seemed to approximate the decline in value.

Mathematically, it is the same as the annuity method, in which "condition per cent" is measured by the ratio of the present value of the future annuity to the original value at some assumed interest rate. The arithmetic sum method is the equivalent of the annuity method at zero per cent interest. In justification of the use of the annuity method in one form or another, it will be recognized that we are dealing fundamentally with service values to be expressed in monetary units sooner or later, and such values occurring at different times can be combined significantly only by the introduction of an interest component.

The extent of the implied assumptions that unconsciously underlie all estimates of "condition per cent" can be best illustrated by examples:

An inventory shows 131,023 chestnut poles of varying age from those just set to some in their eighteenth year. The expectation of life at age 0 was twelve years. It is required to find the "condition per cent" of the 8,755 units now in year six of age. Poles falling in the structural class presumably develop no units of service that vary with time, and "condition per cent" is:

(1) Estimated at six years old. Condition per cent is 6 divided by 12, or 50 per cent.

(2) Utility's engineers maintain the poles were specially inspected—ground conditions were favorable; ground-line rot has been minimized by original and subsequent brush treatment—and generally undertake to develop a higher condition. They induce a compromise on eight years' additional life and a "condition per cent" of 8 ÷ 14, or 57.2 per cent.

(3) Another attempt to lift the "condition" is made by the application of the annuity-due method: (a) Using twelve years' expectation and six years' gone, "condition" is ratio of

$$\frac{a12}{a6} = \frac{5.45}{10.00} = 54.5 \text{ per cent};$$

(b) using twelve years' expectation and eight years' probable future life:

$$\frac{a8}{a12} = \frac{7.00}{10.00} = 70.0 \text{ per cent};$$

*IN THIS SECOND ARTICLE on depreciation James D. Mortimer concludes the discussion of various aspects of the problem following a preliminary article on the subject in last week's issue.*

(c) using fourteen years' expectation and eight years' probable future life:

$$\frac{a8}{a14} = \frac{7.00}{10.48} = 63.7 \text{ per cent.}$$

(4) Records show that the line of which the poles form a part did not carry its full load of feeders and mains until the end of the fifth year, but copper and transformers were gradually added. It was then urged that the affirmative service value increased gradually during the first five years from 25 per cent and that the future service value in proportion to the whole had to take this fact into consideration. So there were computed the following relative values:

(a) During the first five years' elapsed time there were only 2.75 service years; with a total expectation of twelve years, there remain 9.25 service years. "Condition per cent" equals 9.25 ÷ 12 = 77.1.

(b) If this future expectation is eight full service years, then "condition per cent" may be 8 ÷ (2.75 + 8) = 74.4.

(c) On the annuity basis the answer might be one of several of which the following is one:

"Condition per cent" =

$$\frac{a8}{a10.75} = \frac{7.00}{9.00\pm} = 77.8.$$

(5) Then there came along the man with "Retirement Table B" and asserted that the past was not known with sufficient accuracy to allow for "special loading" and the future was inscrutable to him, at least, and he proposed to guess relative values by the application of "annuities due" from his table, with the following result:

"Condition per cent" =

$$\frac{a6}{a5} = \frac{1 + 6.16}{1 + 8.69} = 74.1.$$

In summarized form, we arrive at several different answers depending on the line of approach, viz.: A: 50 per cent; B: 57.2 per cent; C (a): 54.5 per cent; C (b): 70 per cent; C (c): 63.7 per cent; D (a): 77.1 per cent; D (b): 74.4 per cent; D (c): 77.8 per cent; E: 74.1 per cent. At $25 each cost new, the "present value" fluctuates between $12.50 and $19.45. The indeterminate nature of question of "condition per cent" is illustrated by these varying answers. They illustrate the hazard to which a significant portion of the country's capital is subjected by the assumption of knowledge where its absence more evidently exists. Original cost of a unit of property is often a question of fact; reproduction cost new is somewhat more often a question of opinion; but "depreciated value" is a matter of opinion all the time. Testing rate schedules by the use of "depreciated value" as a measure of utility capital gives wide opportunity to adjust the "facts" to the end sought.

### Reconciliation of Viewpoints

It has been implied that all viewpoints so often urged have more or less merit to support them. The person who objects to "depreciated value" for rate making more or less appreciates the difficulty of arriving at a figure in which all can have confidence. He realizes also that it results in a shifting base and intuitively feels there is some more important objection than either of these. So the "100 per cent

service value" was conjectured as a defense reaction, and this apparently required that retirement reserve be minimized to some figure suitable to equalize fluctuations in charges. The Interstate Commerce Commission feels itself bound by Supreme Court decisions to use "depreciated value," and this it believes contemplates the gradual withdrawal of the capital in the original facilities by the means of straight-line depreciation; that is, straight-line amortization.

1. The use of life tables of the usual type is a doubtful procedure. The presumption of knowledge underlying the preparation and use of such tables has contributed as much as any one thing to the confusion that now apparently exists. The objection to their indiscriminate use evidently rests on some foundation.

2. Those who advocate charging retirements to expenses only at the time when made assume (a) an unlimited life, subject to correction for retirements actually experienced, and (b) that retirements will occur or can be made to occur in such manner that only a small reserve, if any at all, is required to absorb fluctuations or departures from "average gait."

The major portion of physical property has limited lives, indeterminate though they may be. The utility as a part of its general obligation to serve has a continuing obligation to retire property that has attained its useful life. This liability may be measured by the single premium; it is reduced by the present value of the future annual premiums to be paid under the schedule adopted. If the schedule of premiums is high compared with the single premium, the liability quickly becomes negative; if the schedule of premiums is low or zero, the liability increases with the lapse of time until it matures and is paid in part or in whole through operating expenses.

3. When the premiums are computed on a "straight-line" basis there are no interest credits, and there is an initial negative value of the liability since the present value of such payments is greater than the actual liability. Where the premiums are computed on a "sinking-fund" basis, applied to the number of years' "expectation," there is a small positive initial value. At the end of the fifteenth year, at the beginning of which year expectation was fourteen years, starting with an expectation of twenty-four years, the sinking fund reserve value is 0.558; this compares with Retirement Table B value of 0.3250.

4. Let us now consider another aspect of the different measures of utility capital and the different methods of providing for or insuring retirements. For simplicity we will deal only with a simple group of property which has a limited life. Let

$r$ = rate of return.
$p_1$ = retirement premium per dollar, straight-line basis, plan 1.
$p_2$ = retirement premium per dollar, Retirement Table B, plan 2.
$C_n$ = original cost of property.
$C_1$ = measure of utility capital for rate tests, plan 1.
$C_2$ = measure of utility capital for rate tests, plan 2.
$C_3$ = measure of utility capital for rate tests under plan 3 where retirements are charged to expenses as they occur. .

For equal rates,

$$rC_1 + p_1C_n = rC_2 + p_2C_n = rC_3.$$

When $C_n = 1$

$$C_2 - C_1 = (p_1 - p_2) \div r \text{ and } C_2 - C_3 = -p_2 \div r.$$

If $p_1 = 0.04167$, $p_2 = 0.0280$, $r = 0.08$, then $C_2 - C_1 = 0.181$ and $C_2 - C_3 = -0.327$.

## Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday April 12 | Low 1927 | High 1927 |
|---|---|---|---|
| **ABITIBI PWR. & PAPER, 4% com.—no par** | 92 | 83 | 93 |
| Adirondack Pwr. & Lt.—7% pf. | 107½ | 107 | 109½ |
| Adirondack Pwr. & Lt.—8% pf. | 112 | 112 | 114 |
| Ala. Pwr., 7% pf. | 110½ | 107 | 112½ |
| Allis-Chalmers Mfg., 7% pf. | k110 | 109 | 111½ |
| Allis-Chalmers Mfg., 6% com. | 100½ | 88 | 100½ |
| Aluminum Co. of Amer., com. | 68 | 69½ | 73 |
| Aluminum Co. of Amer., 6% pf. | 102 | 101½ | 104 |
| Amer. & Foreign Pwr., pf. 25% pd. | m110 | .... | 2 |
| Amer. & Foreign Pwr., 7% pf.—no par | 94½ | 86½ | 95 |
| Amer. & Foreign Pwr., com.—no par. | 24½ | 18½ | 25½ |
| Amer. Bosch Magneto, com.—no par | 16½ | 13 | 18½ |
| Amer. Brown Boveri Elec. | 23½ | 21 | 39½ |
| Amer. Brown Boveri Elec., pf. $7. | k86 | 85 | 98 |
| Amer. Gas & Elec., 6% pf.—no par | 100½ | 95½ | 101 |
| Amer. Gas & Elec., com.†—no par | 78½ | 68½ | 100½ |
| Amer. Lt. & Trac., 6% pf. | 125½ | 113 | 125½ |
| Amer. Lt. & Trac., com.† | 230 | 222 | 235 |
| Amer. Pwr. & Lt., 6% pf. | 100 | 97½ | 101 |
| Amer. Pwr. & Lt., com.†—no par | 58½ | 54 | 61½ |
| Amer. Pub. Serv., 7% pf. | a100 | 94 | 100 |
| Amer. Pub. Serv., com.† | 50 | .... | .... |
| Amer. Pub. Utilities, 7% pr. pf. | 90 | 88 | 93 |
| Amer. Pub. Utilities, 7% ptc. pf. | 82 | 73 | 82 |
| Amer. Pub. Utilities, com | 55 | 65 | 70 |
| Amer. States Sec., A | 2½ | 3½ | 4½ |
| Amer. States Sec., B | 3 | 3 | 4½ |
| Amer. Superpwr., $6 pf.—25 | 28½ | 26½ | 28½ |
| Amer. Superpwr., 7% pf. | 96 | .... | .... |
| Amer Superpwr., Class A†—no par | 30½ | 27½ | 30½ |
| Amer. Superpwr., Class B†—no par | 32 | 28½ | 32 |
| Amer. Wtr. Wks. & Elec., 7% pf. | k109½ | 104½ | 110½ |
| Amer. W. W. & E., com. $1.20—20 | 80½ | 62½ | 81½ |
| Anaconda Copper cap. $3 | 46½ | 45 | 49½ |
| Appalachian Electric Pwr., 7% 1st pf. | 102 | 100 | 104 |
| Appalachian Elec. Pwr., 2d pf., 7% | 100 | 100 | 102 |
| Appalachian Elec. Pwr., com. | m78 | .... | .... |
| Arizona Pwr., 7% pf. | 79 | 77 | 84½ |
| Arizona Pwr., com. | 26½ | 22 | 26½ |
| Arkansas Cent. Pwr., pf.—$7 no par. | k102 | 101 | 103 |
| Arkansas Lt. & Pwr., 7% pf. | 103 | 101 | 104 |
| Arkansas Lt. & Pwr., com. | 103 | .... | .... |
| Assoc. Gas & Elec., $3.50—50 | 51 | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par. | 87 | 85 | 90 |
| Assoc. G. & E., Class A, $2.50—no par | 41 | 35 | 42 |
| **BABCOCK & WILCOX, 7% com.** | 119 | 115½ | 124 |
| Binghamton L., H. & P., $6 pf. | 93 | 93 | 95 |
| Birmingham Elec., pf.—$7—no par. | 108 | 105 | 109 |
| Blackstone Valley G. & E., $6 pf. | 103 | 103 | 105 |
| Blackstone Valley Gas & Elec., 10% com.—50 | 120 | 98 | 120 |
| Blaw-Knox, com.† | f 72 | .... | .... |
| Brazilian Trac., Lt. & pwr., com.† | f135 | .... | .... |
| Broad River Pwr., 7% pf. | 101½ | 97 | 100 |
| Brooklyn Edison, 8% com. | 158 | 148½ | 159½ |
| Buffalo, Niagara & East. Pwr., pf.—25 | 25½ | .... | .... |
| Buffalo, Niagara & East. Pwr. com.† —no par | 30 | .... | .... |
| **CALIFORNIA ELEC. GENERATING, 6% pf.** | 97 | 96 | 98 |
| California Ry. & Pwr., 7% pf. | 130 | 125 | 150 |
| Carolina Pwr. & Lt., pf.—$7—no par | f107½ | 107 | 108½ |
| Central & S.W. Util., 7% pf.—no par | a 97½ | 93½ | 97½ |
| Central & S. W. Util., pr. ln. $7 pf. —no par | a101 | 98½ | 101½ |
| Central Ariz. Lt. & Pwr., 7% pf. | 102 | 100 | 100 |
| Central Ark. Ry. & Lt., 7% pf. | 101 | 100 | 102 |
| Central Ill. Pub. Serv., 6% pf. | 102 | .... | .... |
| Central Ind. Pwr., 7% pf. | a 90 | 85½ | 90 |
| Central Pwr. & Lt., 7% pf. | k102 | 100½ | 103 |
| Central States Elec., 7% pf. | 93 | 93 | 96 |
| Central States Elec., com.† | m200 | .... | .... |
| Century Elec., 6% com. | m115 | 115 | 115 |
| Chicago Fuse Mfg., com.—$2.50 no par | a 33½ | 30 | 34½ |
| Cincinnati Gas & Elec., 5% com. | g 96½ | 93½ | 97½ |
| Cities Service, 6% pf. | 90 | 87 | 92½ |
| Cities Service, pf. B—10 | k 8 | 7½ | 8½ |
| Cities Service, pf. BB—100 | k 81½ | 81 | 85½ |
| Cities Service, com.—20 | 51½ | 40½ | 58½ |
| Cities Service, Bka. Shrs.—10 | m 25½ | 25½ | 29½ |
| Clarion River Pwr., 8% pf. | 95 | .... | .... |
| Cleveland Elec. Illg., 6% pf. | 108 | 108 | 109½ |
| Cleveland Elec. Illg., 10% com. | 300 | 302 | 310 |
| Colorado Pwr., 7% pf. | k 95 | 95 | 97½ |
| Columbia Gas & Elec., 6% pf. | 105½ | 99½ | 105½ |
| Columbia G. & E. com. $5—no par | 92½ | 82½ | 93 |
| Columbia Ry., Gas & Elec., 6% pf. | 94 | .... | .... |
| Columbus Elec. & Pwr., 2d. pf. | 108 | .... | .... |
| Columbus Elec. & Pwr., 9% com. | 70½ | .... | .... |
| Columbus Ry., Pwr. & Lt., 6% 1st pf. | 101 | 98½ | 99½ |
| Columbus Ry., Pwr. & Lt., 6½% pf. B | 99 | 96 | 99 |
| Columbus Ry., P. & L., com.—no par | 70 | 75 | 79 |
| Commonwealth Edison, 8% com. | a145 | 138 | 145 |
| Commonwealth Pwr., 6% pf. | 95½ | 91½ | 97 |
| Commonw'th Pwr., $2, com.—no par | 44½ | 42½ | 48 |
| Conn. Lt. & Pwr., 8% pf. | 120 | 119 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 113 | 112 | 113½ |
| Cons. Gas of N. Y., pf.†—50 | 56 | 55½ | 62½ |
| Cons. Gas of N. Y., com $5—no par. | 99 | 94 | 109½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e107½ | 106½ | 107½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf. | e111½ | 111 | 112½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf. | e114 | 112½ | 115½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf. | e127½ | 126 | 129 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par | e 54½ | 51 | 54½ |
| Consolidated Pwr. & Lt., 7% pf. | 101 | 100 | 103 |
| Consumers Pwr., 6% pf. | 102 | 100 | 102 |
| Consumers Pwr., 6.6% pf. | 105 | 103 | 105½ |
| Continental Gas & Elec., 7% ptc. pf. | 105 | 103 | 106½ |
| Continental Gas & Elec., 7% pr. pf. | 103 | 100 | 103 |
| Conti. G. & E. com. $4.40—no par. | k220 | 210 | 225 |
| Crocker Wheeler, com.† | 32 | 26 | 37½ |
| Crocker Wheeler, 7% pf. | 78 | 78 | 88 |
| **DALLAS PWR. & LT., 7% pf.** | 109 | 107 | 109½ |
| Dayton Pwr. & Lt., 6% pf. | 102½ | 101 | 103 |
| Detroit Edison, 8% com. | 140½ | 138½ | 141½ |
| Dubilier Condenser, com.—no par | k 5 | 3½ | 5½ |
| Dubuque Elec., 6% pf. | 109 | 93 | 105 |
| Duquesne Lt., 7% pf. | k116 | 114½ | 116½ |
| **EASTERN NEW YORK UTIL., $7 pf.** | 103 | 102 | 104½ |
| Eastern New York Util. com. | 65 | 70 | 75 |
| Eastern States Pwr., $7, com. | 10 | 11 | 13 |
| Eastern States Pwr., pf. | 91½ | 93 | 95 |
| East. Tex. Elec., 7% pf. | 106 | 106 | 108 |
| East. Tex. Elec., com. $5—no par. | 90 | .... | .... |
| Edison Elec. of Boston, 12% com. | d249 | 217 | 253 |
| El Paso Elec., com. $5—no par. | 70 | .... | .... |
| El Paso Elec., 7% pf. | 108 | 105 | 107½ |
| Elec. Bond & Share, 6% pf. | k108½ | 105½ | 109 |
| Elec. Bd. & Sh. Sec., com. $1—no par | f 68½ | 67½ | 72½ |
| Electric Household Util.† | a 11½ | 11 | 14½ |
| Elec. Investors, 6% pf.—no par. | 94 | 92 | 94 |
| Elec. Investors, com.†—no par. | 36½ | 32½ | 37 |
| Elec. Investors, 10% pd. receipts | 15 | .... | .... |
| Elec. Pwr. & Lt., ctfs. pf. | 101½ | 96 | 101½ |
| Elec. Pwr. & Lt., ctfs., 40% pd. | 110 | 103½ | 110 |
| Elec. Pwr. & Lt., ctfs. full pd. | k108½ | 108½ | 108½ |
| Elec. Pwr. & Lt., ctfs., com.—no par. | 20½ | 16½ | 20½ |
| Elec. Refrig. cap.† | 25 | 22½ | 37½ |
| Elec. Ry. Securities, com.—no par. | 7½ | 5½ | 8 |
| Elec. St. Battery com. $5.25—no par | 69 | 65½ | 79½ |
| Elmira Wtr., Lt. & R.R., 7% pf. | 100½ | 99 | 101½ |
| Emerson Elec., pf. | m105 | .... | .... |
| Empire Pwr., A $6 | 37½ | 26 | 38½ |
| Engr. Pub. Serv., $7 pf.—no par. | k101½ | 93½ | 101½ |
| Engr. Pub. Serv., com.—no par | 25 | 21½ | 25½ |
| Eureka Vacuum Cleaner, com. $4—no par | 70 | 60½ | 72½ |
| **FAIRBANKS MORSE, 7% pf.** | k110½ | 107½ | 112 |
| F.-M., com.—$2.60—no par. | 41 | 38½ | 42½ |
| Federal Lt. & Trac., com.† | 44 | 37½ | 44½ |
| Federal Lt. & Trac., 6% pf. | 96 | 91½ | 99½ |
| Ft. Worth Pwr. & Lt., 7% pf. | k110 | 108 | 112 |
| **GALVESTON-HOUSTON ELEC. 6% pf.** | 72 | 68 | 72 |
| Galveston-Houston Elec., com. | 26 | 28 | 30 |
| Gen. Elec., 8% com. | 90½ | 81 | 91 |
| Gen. Elec., special—10 | 11½ | 11½ | 11½ |
| Gen. Gas & Elec. (Del.) com. A. $1.50—no par | 40½ | 34 | 47½ |
| Gen. G. & E. (Del.) com. B—no par. | 39 | 35½ | 43½ |
| Gen. G. & E. (Del.) pf. A. $8—no par. | k113 | 113½ | 115½ |
| Gen. G. & E. (Del.) pf. A $7—no par. | k102 | 100 | 107½ |
| Gen G. & E. (Del.) pf. B $7 | k 98 | 96 | 99½ |
| Gen. Pub. Serv., com. | k108 | 105½ | 108 |
| Gen. Pub. Serv., com. | 13 | 11½ | 14½ |
| Ga. Lt., Pwr. & Rys., 6% pf. | 85 | 87 | 92 |
| Ga. Lt., Pwr., & Rys., com. | m 60 | .... | .... |
| Ga. Ry. & Pwr., 8% pf. | k122 | 119 | 123 |
| Ga. Ry. & Pwr., 7% pf. | 112 | 106 | 110 |
| Ga. Ry. & Pwr., 4% pf. | m119 | .... | .... |
| Ga. Ry. & Pwr., 4% com. | 120 | .... | .... |
| Gt. Western Pwr., 7% pf. | h102½ | .... | .... |
| **IDAHO PWR., 7% pf.** | 107 | 103 | 105 |
| Ill. No. Utilities, 6% pf. | k 88 | 88 | 92 |
| Ill. Pwr. & Lt., 7% pf. | 100½ | 99 | 101 |
| Ingersoll Rand com. $8 | k 93½ | 92 | 96½ |
| Int. Combus. Engr., com. $2—no par | 53½ | 43½ | 64 |
| Int. Util., Class A—$3.50—no par. | k 34½ | 28½ | 35½ |
| Int. Utilities, Class B—no par. | 3½ | 3 | 5½ |
| Interstate Pwr., pf.—$7—no par. | 94 | 93 | 97 |
| Interstate Pub. Serv., 7% pf. | 100 | 98 | 99½ |
| Iowa Ry. & Lt., 7% pf. | 98 | 97 | 99 |
| **JERSEY CENTRAL PWR. & LT., 7% pf.** | 101 | 97½ | 98½ |
| Jersey Cent. Pwr. & Lt., 7% ptc. pf. | 115 | 111 | 115 |
| Jersey Cen. Pwr. & Lt., com.—no par | k 25 | .... | .... |
| Johns-Manville, com.†—no par. | 65½ | 55½ | 73½ |

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, April 9. lBid price Wednesday, April 13. mLatest quotations available. †Dividend rate variable.

## Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday April 12 | Low 1927 | High 1927 |
|---|---|---|---|
| **KANSAS CITY PWR. & LT. pf.$7** | *k*113 | 112 | 114¼ |
| Kansas Gas & Elec., 7% pf. | *l*105 | 103 | 104 |
| Kentucky Hydro-Elec., 7% pf. | *a*95½ | 94¼ | 97½ |
| Kentucky Sec.,6% pf. | 86 | 83 | 87 |
| Kentucky Sec., 5% com. | 107 | 110 | 115 |
| Kentucky Utilities, 6% pf. | 96 | 95 | 96½ |
| Keystone Pwr. & Lt., 7% pf. | 99 | 96 | 98½ |
| **LACLEDE GAS LT., 8% com.** | 195 | 173½ | 195 |
| Lehigh Pwr. Sec., com.—no par. | 19½ | 15 | 20 |
| Long Island Ltg., 7% pf. | 109 | 107 | 109 |
| Long Island Ltg., com. $2—no par. | 140 | 139 | 153 |
| Los Angeles Gas & Elec., 6% pf. | 99 | 98 | 100½ |
| Louisville Gas & Elec., cl. A. $1.75 | 26½ | 23½ | 27½ |
| **MAN. ELEC. SUPPLY, cap. $4.25—no par** | 66½ | 53½ | 72 |
| Manila Elec., com.†—no par. | *k*44½ | 40 | 46 |
| Maytag Mfg., com. .50—no par. | 28 | 23½ | 28½ |
| Memphis P. & L., pf.—$7—no par | 108½ | 107 | 109 |
| Metropolitan Ed., pf.—$6—no par. | 98½ | 93 | 97 |
| Metropolitan Ed., pf.—$7—no par. | 106 | 104 | 108 |
| Metropolitan Ed., com. $5—no par. | 67 | .... | .... |
| Middle West Utilities, 7% pf. | *a*108½ | 105½ | 113½ |
| Middle West Util., 7% pr. lien pf. | *a*118 | 117½ | 120 |
| Middle West Util., com. $6—no par | *a*112 | 108 | 114½ |
| Midland Utilities, pr. ln. 7% pf. | *a*102 | 98 | 102½ |
| Midland Utilities, 7% pf. A. | *a* 98 | 96½ | 99½ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | *k*101 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | *k*99 | 98 | 101 |
| Minn. Pwr. & Lt., 7% pf. | *l*105½ | 104 | 105 |
| Miss. Pwr. & Lt., $8 pf. | 109½ | 106 | 111 |
| Miss. River Pwr., 6% pf. | 98 | 94 | 97 |
| Miss. River Pwr., com. | 62 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | 103 | 100 | 104 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | 100 | 98 | 101½ |
| Mohawk Hudson Pwr., com.—no par | *k*24½ | 20½ | 27 |
| Montana Pwr., 7% pf. | *m*123 | 118½ | 123 |
| Montana Pwr., 4% com. | 95 | 81½ | 96½ |
| Montreal Pwr. 7% com. | *f* 82 | .... | .... |
| Mountain States Pwr., 7% pf. | 99 | 97 | 101 |
| Mountain States pwr., com.† | 18 | .... | .... |
| **NASSAU & SUFFOLK LTG., 7% pf.** | 108 | 98 | 105 |
| National Carbon, 8% pf. | *m*137 | 130½ | 137½ |
| National Elec. Pwr., A† | *a* 25 | 23½ | 25½ |
| National Elec. Pwr., 7% pf. | *a* 96½ | 96 | 96½ |
| National Lt., Ht. & Pwr., com. | 24 | .... | .... |
| National Light, Ht. & Pwr., 6% pf. | 70 | .... | .... |
| National Pwr. & Lt., pf.—$7—no par | 105½ | 101 | 106½ |
| National Pwr. & Lt., com.†—no par. | 23½ | 19½ | 23½ |
| National Pub. Serv., 7% pf. | *k*95½ | 93 | 96 |
| National Pub. Serv., 7% ptc., pf. | 113 | 108 | 115 |
| National Pub. Serv., A com. $1.60—no par | 22 | 18½ | 22½ |
| National Pub. Serv., B com.—no par | *k*18½ | 14 | 20½ |
| Nebraska Pwr., 7% pf. | *l*109 | 106 | 108½ |
| Nevada-Calif. Elec., com. | 31 | 24½ | 31 |
| New Brunswick Pwr., 7% pf. | 55 | .... | .... |
| New Eng. Pub. Serv., pr. ln. pf. $7.. | 99½ | 98½ | 101 |
| New Eng. Pub. Serv., pf. $7. | 96 | 95 | 97 |
| N. J. Pwr. & Lt., 6% pf. | 93 | .... | .... |
| New Orleans Pub. Serv.—7% pf. | 105½ | 103 | 105 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 90 | .... | .... |
| N. Y. Central Elec., 7% pf. | 102 | 102 | 104 |
| Newport News & Hampton Ry., Gas & Elec., 5% com. | 109 | .... | .... |
| Newport News & Hampton Ry., Gas & Elec., 7% pf. | 109 | .... | .... |
| Niagara Falls Pwr., 7% pf.—25. | 28½ | 27½ | 29 |
| Niagara, Lock. & Ont. Pwr., 7% pf. | 111 | 110½ | 113 |
| No. Amer., 6% pf.—50. | 51½ | 50 | 52 |
| No. Amer., com.—10. | 50½ | 45½ | 50½ |
| No. Amer. Edison, $6 pf.—no par. | 101 | 96½ | 101½ |
| No. Caro. Pub. Serv., pf.—$7—no par | 97 | 93 | 97 |
| Northeastern Pwr., com. | 15½ | 15 | 18½ |
| No. Indiana Gas & Elec., 7% pf. A. | 103 | 102 | 104 |
| No. N. Y. Utilities, 7% pf. | 104 | 103 | 105½ |
| No. Ohio Pwr., com.—no par. | 11½ | 9½ | 13½ |
| No. Ohio Trac. & Lt., 6% pf. | 80 | 78 | 81 |
| No. Ohio Trac. & Lt., 7% pf. | 90 | 90 | 93 |
| No. Ont. Lt. & Pwr., 6% pf. | *k* 90 | 84 | 90 |
| No. Ont. Lt. & Pwr., 4% com. | 74 | 73 | 78 |
| No. States Pwr., (Del.) 7% pf. | 103 | 101 | 104 |
| No. States Pwr., 8% com. | 117½ | 109½ | 117½ |
| No. Texas Elec., 6% pf. | 71 | 65 | 70 |
| No. Texas Elec., 4% com. | 30 | 27 | 36 |
| **OHIO BRASS, com. B $4—no par.** | 80 | 74 | 85 |
| Ohio Brass, 6% pf. | 102 | 100 | 103 |
| Ohio Gas & Elec., 7% pf. | 100 | 95 | 97 |
| Ohio Pwr., 6% pf. | 100 | 96 | 99 |
| Ohio Pub. Serv., 6% pf. | 95 | 95 | 96½ |
| Ohio Pub. Serv., 7% pf. | 105 | 103 | 105½ |
| Ohio River Edison, 7% pf. | 106½ | 103 | 105½ |
| Oklahoma Gas & Elec., pf. | 99 | .... | .... |
| **PACIFIC GAS & ELEC., 6% pf.** | 24½ | 24½ | 25½ |
| Pacific Gas & Elec., 8% new com. | 33½ | 31 | 33½ |
| Pacific Pwr. & Lt., 7% pf. | *l*103 | 102 | 104 |
| Parr Shoals Pwr., 6% pf. | 92 | .... | .... |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | *c* 74½ | 71½ | 75 |
| Penn-Ohio Edison, 7% pf. | 101½ | 97½ | 101½ |
| Penn-Ohio Elec., 7% pf. | 100 | 98 | 100 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 102 | 99 | 102 |
| Penn-Ohio Pwr. & Lt., 8% pf. | 111 | 109 | 112 |
| Penn Pwr. & Lt.—$7—no par. | *l*108½ | 107 | 108½ |
| Penn. Pub. Serv., 6% pf. | 87 | .... | .... |
| Penn Wtr. & Pwr., 8% com. | *a*190 | 176 | 185 |
| Phila. Co., 6% pf.—50. | *c*51 | 49½ | 52 |
| Phila. Co., com.—50. | 103½ | 85½ | 110 |
| Phila. Elec., 8% com.—25. | *c* 49½ | 46½ | 54 |
| Portland Elec. Pwr., 7% pf. | 97 | 97½ | 100 |
| Portland Elec. Pwr., 6% pf. | 76 | .... | .... |
| Portland Elec. Pwr., 6% 2d pf. | 55 | 68 | 70 |
| Portland Elec. Pwr., com. | 15 | 28 | 30 |
| Potomac Elec. Pwr., pf. | *l*105½ | .... | .... |
| Pwr. Corp. of N. Y., com. $1—no par | *m* 79 | .... | .... |
| Pwr. Sec., pf.—no par. | *k* 28 | 28 | 33 |
| Pwr. Sec., com.—no par. | *k* 6 | 5 | 8 |
| Public Serv. of Colorado, 7% pf. | 96 | .... | .... |
| Pub. Serv. of N. J., 7% pf. | 112½ | 108½ | 115½ |
| Pub. Serv. of N. J., 8% pf. | 128 | 125 | 128 |
| P. S. of N. J., $5 com.—no par. | 39½ | 32 | 39½ |
| Pub. Serv. of No. Ill., 6% pf. | *a*104½ | 102 | 105 |
| Pub. Serv. of No. Ill., 7% pf. | *a*116 | 113½ | 116½ |
| P. S. of No. Ill., com. $8—no par. | *a*142 | 130½ | 142 |
| Pub. Serv. of No Ill., 8% com. | *a*139 | 132 | 139 |
| Pub. Serv. of Okla., 7% pf. | 98 | 99 | 100½ |
| Pub. Serv. Elec. & Gas, 6% pf. | 105½ | 102 | 105½ |
| Pub. Serv. Elec. Pwr., 7% pf. | *k*116½ | 113½ | 116½ |
| Puget Sound Pwr. & Lt., 7% pf. | 107 | 105 | 107 |
| Puget Sound Pwr. & Lt., 6% pf. | 85 | .... | .... |
| Puget Sound Pwr. & Lt., com. | 28 | 28 | 33½ |
| **RADIO CORP. OF AMER., pf.—50** | 50½ | 50½ | 53 |
| Radio Corp. of Amer., com.—no par. | 43 | 42½ | 50½ |
| Republic Ry. & Lt., pf. | *k*120 | .... | .... |
| Republic Ry. & Lt., com. | *k*122 | 112 | 135 |
| Rochester Gas & Elec., 7% pf. B. | 106 | 105 | 107 |
| Rochester Gas & Elec., 6% pf. D. | *k*103 | 101 | 103½ |
| Rochester Gas & Elec., 6% pf. C. | 103 | 101½ | 103½ |
| **SAFETY CABLE, com. $4.** | 63½ | 52½ | 64½ |
| San Joaquin Lt. & Pwr., 7% pf. | 107 | 105 | 108 |
| St. Joseph Ry., L., H. & P., 5% pf. | 71 | 70 | 73 |
| Servel Corp. | 6 | 5½ | 10½ |
| Sierra Pacific Elec., com. | 28½ | 26½ | 28½ |
| Sioux City Gas & Elec., 7% pf. | 103 | 99 | 101½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | 104½ | .... | .... |
| Southeastern Pwr. & Lt., $6 pfc. pf., | 75½ | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 31½ | 29½ | 32½ |
| So. Calif. Edison, 8% pf. | 35 | 36½ | 38 |
| So. Calif. Edison, 7% pf. | 27½ | 27½ | 25½ |
| So. Calif. Edison, 6% pf. | 24½ | 24½ | 25½ |
| So. Calif. Edison, 8% com. | 33½ | 31½ | 34½ |
| Southern Cities Utilities, 7% pf. | 87 | 81 | 86 |
| Southern Cities Utilities, com. $4. | 39 | .... | .... |
| Southwestern Lt. & Pwr., A $3. | 63 | 60 | 65 |
| Southwestern Lt. & Pwr., B. | 63 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf. | 86 | 83 | 86 |
| Southwestern Pwr. & Lt., 7% pf. | 107½ | 104 | 107½ |
| Springfield (Mo.) Ry. & Lt., 7% pf. | 99 | 95 | 100 |
| Standard Gas & Elec., 8% pf | 59½ | 57½ | 60 |
| Standard Gas & Elec., 7% pf. | 108 | 104½ | 109 |
| Standard G. & E., com. $3—no par. | 55½ | 54 | 58 |
| Standard Pwr. & Lt., 7% pf. | 99½ | 98 | 100 |
| Staten Island Edison, pf.—$6—no par | 101 | 99 | 101 |
| Superheater, $6 com.—no par. | 174 | .... | .... |
| Syracuse Lighting, 7% pf. | 105 | 103 | 107 |
| Syracuse Lighting, 8% pf. | 115 | .... | .... |
| Syracuse Lighting, 8% com. | 300 | .... | .... |
| **TAMPA ELEC., com. $2.** | 61½ | 49 | 62½ |
| Tenn. Elec. Pwr., 6% pf. | 95 | 92 | 94½ |
| Tenn. Elec. Pwr., 7% pf. | 105½ | 103 | 106½ |
| Terre Haute, Ind. & East. Trac., 5% pf. | 20 | 20 | 25 |
| Terre Haute, Ind. & East. Trac., com | 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf. | *l*108½ | 106 | 108 |
| Tide Water Pwr., 8% pf. | 106 | 105 | 108 |
| Timken Roller Bear., com.—$4 no par. | 87½ | 78 | 95½ |
| Toledo Edison, 8% pf. | 115½ | 115 | 118 |
| Toledo Edison, 7% pf. | *k*107½ | 105 | 108½ |
| Toledo Edison, 6% pf. | *k* 95 | 95 | 97 |
| Toledo Edison, 6% com. | 100 | .... | .... |
| Tri-City Ry. & Lt., 6% pf. | 96 | 90 | 97 |
| **UNITED GAS & ELEC., 6% pf.** | 99 | 98 | 99½ |
| United Gas & Elec., com.—no par. | *m* 57 | .... | .... |
| United Gas & Elec. (N. J.) 5% pf. | 72 | 70 | 73 |
| United Gas Impr., 8% com.—50. | *c* 99½ | 89½ | 99½ |
| United Lt. & Pwr., pf.—$4—no par. | 50½ | 49 | 53½ |
| United Lt. & Pwr., pf.—$6.50—no par. | 94½ | 87 | 94½ |
| United L. & P., com. A .48—no par. | 13½ | 12½ | 15½ |
| United L. & P., com. B .48—no par. | *a* 16 | .... | .... |
| Utah Pwr. & Lt., 7% pf. | *l* 106½ | 104 | 105 |
| Utica Gas & Elec., 7% p. | 105 | 105 | 106½ |
| Utica Gas & Elec., 8% com. | 200 | .... | .... |
| Utilities Pwr. & Lt., 7% pf. | 94 | 93 | 98 |
| Utilities Pwr. & Lt., com. A $2. | 28½ | 27 | 30½ |
| Utilities Pwr. & Lt., com. B $1—no par. | *k* 14 | 13½ | 15½ |
| **VERMONT HYDRO-ELEC., 7% pf.** | 97 | 95 | 97½ |
| Virginia Elec. & Pwr., 7% pf. | 107 | 105 | 107 |
| Virginian Pwr., 7% pf. | 108 | .... | .... |
| Virginian Pwr., com. | 70 | .... | .... |
| **WAGNER ELEC., 7% pf.** | *b* 80 | 68 | 81 |
| Wagner Elec., com.†—no par. | *b* 25½ | 18½ | 25½ |
| Washington Ry. & Elec., 5% com. | *f*225 | .... | .... |
| Washington Ry. & Elec., 5% pf. | *f* 91½ | .... | .... |
| Washington Wtr. Pwr., 8% com. | 140 | 136 | 140 |
| West Mo. Pwr., 7% pf. | *m*92 | .... | .... |
| West Penn Elec., 7% pf. | 106½ | 102 | 107½ |
| West Penn Elec., Cl. A $7. | 102½ | 97½ | 103 |
| West Penn Pwr., 7% pf. | 115½ | 111 | 115½ |
| West Penn Pwr., 6% pf. | 105 | 100½ | 105½ |
| West Virginia Lt., Ht. & Pwr., 7% pf. | 93 | 94 | 96 |
| West Va. Utilities, 7% pf.—50. | 49 | 48 | 51½ |
| Western Pwr., 7% pf. | 99½ | 98 | 102 |
| Western States Gas & Elec., 7% pf. | 96½ | 96 | 98 |
| Western States Gas & Elec., com. | 18 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50. | 75½ | 67½ | 76½ |
| Weston Elec. Instrument, Cl. A $2.01—no par. | *k* 33½ | 30½ | 34½ |
| Weston Elec. Instrument, com.—no par. | 16½ | 15 | 18½ |
| Wheeling Elec., 6% pf. | 100 | 95 | 97 |
| Wis., Pwr., Lt. & Ht., 7% pf. | *k* 95 | 95 | 97 |
| Worthington Pump, 7% pf. A. | *k* 53 | 46 | 54½ |
| Worthington Pump, 6% B. | *k* 43½ | 40 | 45 |
| Worthington Pump, com. | 30 | 20½ | 31½ |
| **YALE & TOWNE com. $5—25.** | 74½ | 70½ | 76 |

Stock Exchange: *c*Chicago; *b*St. Louis; *e*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, April 9. *l*Bid price Wednesday, April 13. *m*Latest quotations available. †Dividend rate variable.

Under these assumptions, whenever accrued depreciation is greater than 0.181, plan 1 will give lower rates than plan 2, and plan 3 will give lower rates than plan 2 whenever the value is less than 132.7 per cent of original cost.

In the absence of greater uniformity in the application of essential principles, three identical properties, each with the same original capital invested, having the same ordinary operating expenses and taxes, will presumably have different rate schedules, depending on the methods of measuring utility capital for rate making and providing for retirements. With such an outlook there is no such thing as scientific regulation of rates and the practice of regulation trails off into the realm of conjecture. Thus regulation can be looked on as a necessary evil and something to be suffered rather than enjoyed.

6. Where the accumulation of retirement reserve credits is postponed until property has attained some appreciable age, it is interesting to speculate on the relation of that practice to the amount available for return:

Commissions will assume that the reserve credits began when proporty was new, and for the kinds of property that might be represented by Retirement Table B will, we will say, allow an annual premium of 0.0276 per dollar of cost. If return is 8 per cent, there is a combined allowance of 0.1076. If the accumulation is postponed until the beginning of the year 10, the premium for retirements is increased to 0.0420 and the amount available for return is reduced to 0.0656; this is 8 per cent on 0.820. The difference between 0.820 and 1.0 represents the reserve that would have accumulated had premiums been started at age 0.

There are utility companies which over a long period of years have accumulated retirement reserves of large relative amounts. It is entirely possible that a careful analysis would show that the intended purpose of the practice of building up such reserves had already been accomplished and original cost less Retirement Table B reserves was equal to or more than the liabilities on account of debt and capital shares; such appreciation as exists because of rise in price level may be held as a shock absorber.

To speculate where adherence to a given theory will eventually place a utility is not the purpose of these notes. All the varying points of view have back of them the best of intentions, but they do not lead to the same ultimate answer, as is so often asserted. It is mere conjecture to anticipate that state regulation will become standardized as life insurance practice is believed to have become. Such is hardly likely to prove the case, if the theory underlying the practice contemplated by the I.C.C. opinion of Nov. 2, 1926, spreads from interstate commerce to intrastate utilities.

# Curtailment in Industrial Production

## Productive Activity in March 4.9 Per Cent Under February—Iron and Steel and Automobile Plants Only Two Industries to Report Increased Activity

QUITE a noticeable recession in the productive activities of the manufacturing plants of the nation, taken as a whole, was reported during March. This is shown after corrections are made for the number of working days in March and February. If the two previous years are to be accepted as a basis for comparison, the recession during March was due to influences other than those seasonal in nature. Such is the picture of American industrial productive operations as indicated by reports received by the ELECTRICAL WORLD on the consumption of electrical energy by the manufacturing plants of the nation—plants consuming more than 9,000,000,000 kw.-hr. per annum.

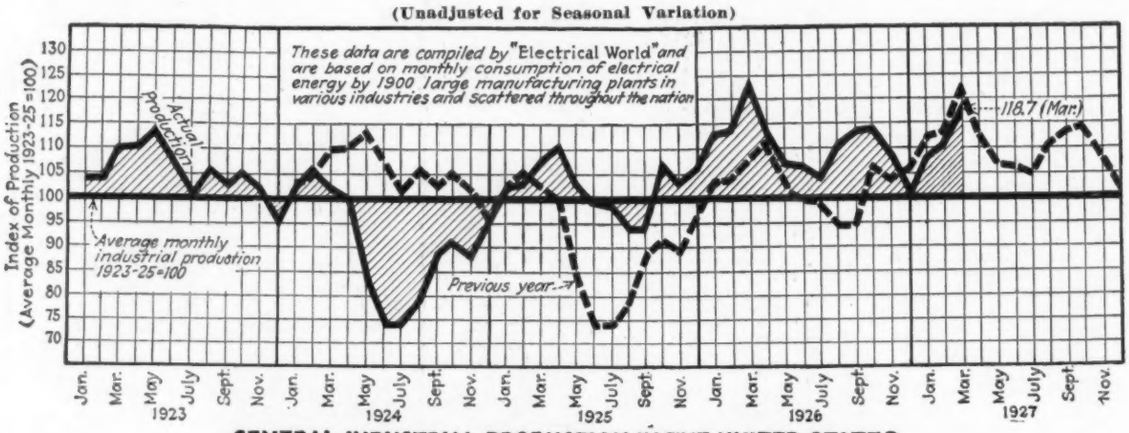
All of the leading primary industries, with the exception of the rolling mills and the automobile plants, reported a rate of production under that of February, and only the rolling mills, textile plants and paper and pulp mills were operating above March of last year. The productive activity of industry as a whole during March was 4.9 per cent under February and 3.5 per cent under March of last year. The rolling mills and iron and steel mills reported productive activities 1.1 per cent over February, and the automobile plants were operating at 2.6 per cent over February. On the other hand seven outstanding primary industries reported the following decreases in activity under February: Metal industries as a group, 3.0 per cent; metal fabricating plants, including both ferrous and non-ferrous plants, 8.3 per cent; leather and its products, 10.2 per cent; textiles, 6.0 per cent; lumber, 12.7 per cent; stone, clay and glass, 6.2 per cent; paper and pulp, 7.5 per cent, and rubber and its products, 2.5 per cent.

As is shown in the accompanying chart, owing to the larger number of working days during March the actual production of the manufacturing plants of the nation was materially above that for February, this increased production being especially noticeable in the iron and steel mills and the automobile plants. Actual production in the lumber mills and in the paper and pulp mills, however, was below that of February. General industrial production during the first quarter of the year was 3.9 per cent under that recorded for the same period of 1926. The outlook for the second quarter of 1927 seems to be for more than a seasonable recession in industrial activity as the period unfolds.

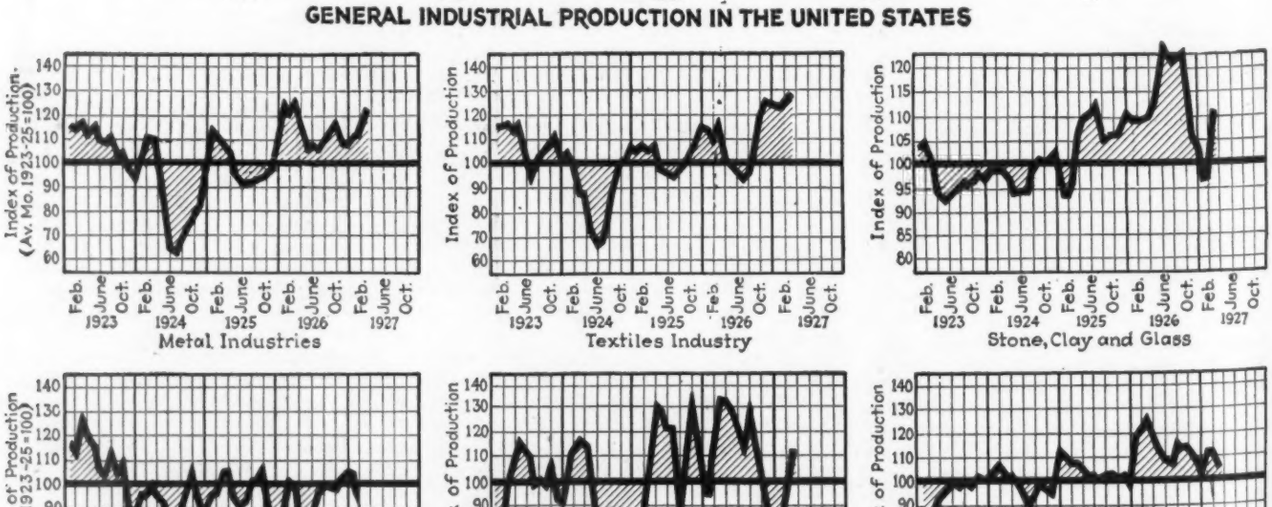
The two outstanding factors during the past month were the record productive activities of the iron and steel mills and the production of automobiles. The productive activities of the rolling mills and of the iron and steel mills were 1.1 per cent over February and slightly above that of March of last year. On the other hand, the metal-fabricating branches of the metal industries, which branch includes both ferrous and non-ferrous working plants, were operating at about 8.3 per cent under February and also under last year.

The rate of production in the automobile plants was 2.6 per cent above February and about 112 per cent above the low productive activities reported for December.

(Unadjusted for Seasonal Variation)


These data are compiled by "Electrical World" and are based on monthly consumption of electrical energy by 1900 large manufacturing plants in various industries and scattered throughout the nation
Index of Production (Average Monthly 1923-25=100)
Actual production
Average monthly industrial production 1923-25=100
Previous year
118.7 (Mar.)
Jan. Mar. May July Sept. Nov.
1923 1924 1925 1926 1927

GENERAL INDUSTRIAL PRODUCTION IN THE UNITED STATES




PRODUCTION IN THE PRIMARY INDUSTRIES OF THE UNITED STATES

# Manufacturing and Markets

## Heavy Construction Volume on Par with 1926

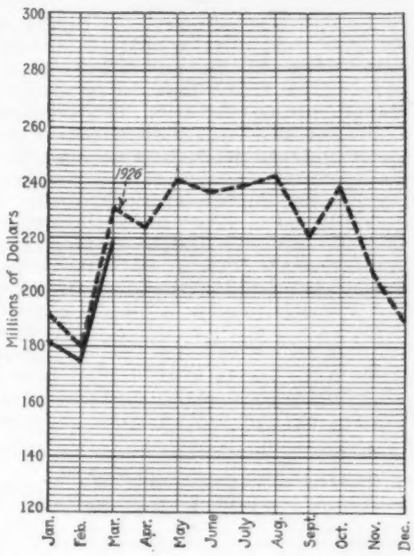
### Decrease Feared Has Not Developed—Most Classes of Work Show Virtually the Same Volume

STATISTICS covering the engineering construction of the country show that for the first quarter of 1927 construction is about on a par with that in the same period of 1926. The let-down that some have feared has not developed. Despite impressions to the contrary, the *Engineering News-Record* contract statistics, which cover heavy construction volume, show the almost identical trend of 1926 and 1927. The total is $630,000,000 for thirteen weeks this year against $601,000,000 for twelve weeks last year. This practical equality holds for most of the classes of work, as shown by the following figures for 1927 and 1926 respectively: Waterworks, $17,000,000 and $15,000,000; sewers, $20,000,000 and $19,000,000; bridges, $13,000,000 and $14,000,000; roads, $66,000,000 and $62,000,000; public buildings, $49,000,000 and $43,000,000; federal government, $10,000,000 and $10,000,000. Even the volume of large commercial buildings—which include the speculative ventures that were recently put under fire—is 18 per cent above that for the first quarter of 1926. The only important decrease was in industrial buildings, $56,000,000 against $104,000,000 in 1926. The cost situation, meanwhile, far from developing any crises improved even under the heavy demand for materials and labor. The significant fact in all of these figures is that the record of the year so far confirms the judgment of those who could see no basic reason for changed economic conditions nor for a pronounced let-down in construction operations and confounds those who felt that, because every good thing must some time cease, now was the time for the cessation of the high degree of construction the last few years have experienced.

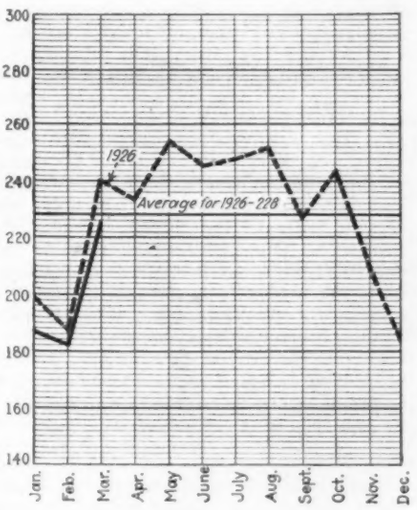
The construction volume index number for the month of March is 226, while it was 228 for the whole of 1926, as against 100 for 1913. This means that the actual volume of contract letting in 1926, and not the mere money value of the contracts let that year, is 128 per cent above the volume for 1913. The monthly volume number, 226 for March, 1927, contains the increment of construction and indicates the rate at which contracts are being let as compared with 1913 awards.

Figures in the accompanying table are for the nation as a whole and are based on a minimum value for each class of work, as follows: Waterworks, excavations, drainage, irrigation, levee, river and harbor projects, $15,000; other public work, $25,000; industrial buildings, $40,000; and commercial, educational and other buildings, $150,000.

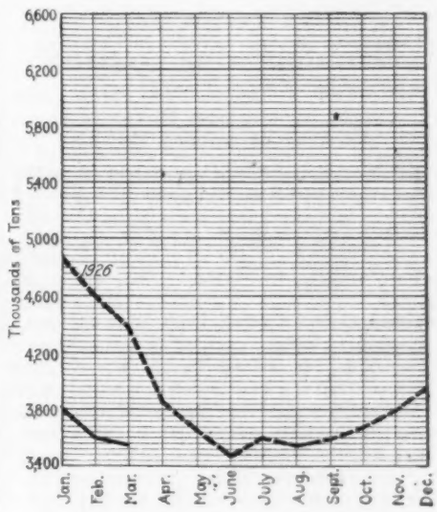
The demand for materials as indicated by the volume of construction contract letting is approximately 5 per cent under a year ago, while advance in costs, owing mostly to labor, repre-




CONTRACTS AWARDED IN THE UNITED STATES




CONSTRUCTION VOLUME AS COMPARED WITH AN INDEX OF 100 FOR 1913




UNFILLED TONNAGE AS REPORTED BY THE UNITED STATES STEEL CORPORATION

In the chart at the left the actual volume of construction is compared and not the mere money value of contracts let. (*Engineering News-Record* statistics.)

VALUE OF CONTRACTS AWARDED IN THE UNITED STATES AND CANADA, MARCH, 1927

| | New England | Middle Atlantic | South | Middle West | West of Mississippi | Far West | United States | Jan. 1 to Date U. S. | Canada |
|---|---|---|---|---|---|---|---|---|---|
| Waterworks | $167,000 | $1,008,000 | $2,197,000 | $3,081,000 | $922,000 | $2,075,000 | $9,450,000 | $16,807,000 | $457,000 |
| Sewers | 60,000 | 3,117,000 | 180,000 | 3,332,000 | 1,558,000 | 705,000 | 8,952,000 | 20,002,000 | 319,000 |
| Bridges | 25,000 | 948,000 | 361,000 | 298,000 | 997,000 | 605,000 | 3,234,000 | 13,020,000 | 200,000 |
| Excavation, drainage, irrigation | | 414,000 | 861,000 | 54,000 | 4,748,000 | 835,000 | 6,912,000 | 8,459,000 | 25,000 |
| Streets and roads | 112,000 | 6,002,000 | 4,875,000 | 7,947,000 | 6,156,000 | 4,073,000 | 29,165,000 | 65,283,000 | |
| Industrial buildings | 6,600,000 | 5,624,000 | 1,795,000 | 3,440,000 | 4,107,000 | 2,907,000 | 24,473,000 | 55,004,000 | 1,056,000 |
| Commercial buildings | 13,371,000 | 41,687,000 | 1,965,000 | 6,526,000 | 21,447,000 | 17,913,000 | 103,909,000 | 302,614,000 | 2,175,000 |
| Federal government | 1,531,000 | 2,381,000 | 124,000 | 84,000 | 191,000 | 576,000 | 4,887,000 | 10,464,000 | |
| Unclassified | 118,000 | 23,075,000 | 4,411,000 | 4,182,000 | 23,178,000 | 492,000 | 55,456,000 | 77,695,000 | 1,063,000 |
| March, 1927 | $21,984,000 | $84,256,000 | $16,769,000 | $56,944,000 | $63,304,000 | $30,181,000 | $273,438,000 | $630,448,000 | $5,309,000 |
| February, 1927 | 9,937,000 | 42,439,000 | 21,008,000 | 45,832,000 | 30,123,000 | 25,931,000 | 175,270,000 | | 3,594,000 |
| March, 1926 | 11,983,000 | 99,556,000 | 25,140,000 | 46,524,000 | 24,565,000 | 22,552,000 | 230,320,000 | | 10,818,000 |
| Jan. 1 to date, 1927 | 50,446,000 | 178,076,000 | 50,493,000 | 142,880,000 | 117,868,000 | 90,685,000 | 630,448,000 | | 13,931,000 |
| Jan. 1 to date, 1926 | 28,812,000 | 233,970,000 | 82,448,000 | 124,883,000 | 70,639,000 | 60,247,000 | 600,999,000 | | 22,954,000 |

NOTE.—Owing to five weeks of construction contracts being included in some months, as in September, the figure for the total contracts let, as shown in the table, does not agree with the figure as represented in the curve.

In order to obtain comparable figures the curve is worked out on a four-week basis for each month.

sents a small fraction of 1 per cent, compared with April, 1926. A sufficiently large volume of construction work is already under contract to provide virtually full employment for the nation's building trades operatives during the current quarter. The present tendency is strongly in the direction of settlement at 1926 wage rates and conditions in the construction industry.

ROAD CONSTRUCTION PROGRAM

Road construction and maintenance programs for 1927 in 47 states, according to reports received by the Bureau of Public Roads, United States Department of Agriculture, indicate the construction of 26,841 miles of road and the maintenance of 239,847 miles. The programs also include the construction of a number of large bridges and the reconstruction of roads previously improved. On account of uncertainty of supporting legislation no estimate of the season's work is possible as yet in the State of Connecticut. In carrying out the above programs it is expected that there will be expended under the supervision of the state highway departments in the 47 states a total of $648,483,000. In addition to the state expenditures, approximate estimates indicate that counties and other lesser subdivisions of government will expend during the year $475,000,000.

## Manufacturing Activity

**Preventing a Decline in Prices and Stabilizing Business Discussed at Academy of Science Meeting**

UNPARALLELED increase in manufacturing activity in the United States has been due mainly to the following chief causes: (1) The rapid increase in the supply of capital (in 1922 there was approximately four times as much capital combined with each man-hour of effort as in 1880, and the previous rate of increase of 5 per cent per year has probably been raised still further during the last five years); (2) the development of improved technical methods, more particularly the extensive use of the moving conveyor, which is the most notable contribution the United States has made to the technique of production; (3) the large internal market within the United States, where complete free trade prevails, thus enabling the increased output to find a wide geographical market; (4) the relative lack of opposition on the part of the workers to improve technique, and (5) the greater equality in the distribution of income in the United States as compared with European countries, which has given a larger share of monetary purchasing power to the workers and has enabled them to consume the increased output of standardized products without the price decline which would have resulted had their total purchasing power been less. This opinion was expressed by Paul H. Douglas, professor of industrial relations, University of Chicago, in an address at the recent semi-annual meeting of the Academy of Political Science held in New York. Professor Douglas further said that in 1926 American manufacturing produced 29 per cent more physical product than in 1919 with approximately 10 per cent fewer workers. The output per worker was thus 43 per cent greater than it had been in 1919 and virtually all of this increase has occurred since 1921.

In discussing wages and a means for arresting the decline of prices and the stabilization of business Professor Douglas said that wages since 1919 have advanced by approximately 19 per cent, or by less than the increase in manufacturing efficiency. This increase in wages has largely been caused by the heightened productivity of industry. Henry Ford's doctrine that it is necessary to pay higher wages in order to create a market for one's product is incorrect when applied to an individual enterprise or industry, since the workers in that firm or industry will spend but a small fraction of their increased income upon the particular goods that it produces. There is, however, some truth in the theory when it is applied to all industry as a whole. Increased production of commodities will cause the price level to fall unless the supply of money and credit offered in exchange increases commensurately. The decline of prices can thus be arrested and business stabilized.

The government, by carrying on public works, could also give additional purchasing power to labor and lessen the danger of business depression. It could derive the funds needed for these improvements by borrowing and, if properly guarded against inflation, by the issuance of money. This would throw additional purchasing power into the hands of the laborers and prevent the price level from falling. The nation would thus build up a system of roads, parks, school buildings etc., from effort that would otherwise be wasted in the idleness of business depressions. It would in a sense be costless social capital. It would be necessary, however, to exercise great self-restraint in not issuing more money than was needed to keep the price level constant and to prevent non-employment from rising above approximately 5 per cent.

# Business Conditions

BUYING of electrical equipment and supplies, while not very active, is favorable. Central-station companies are placing orders in fair volume, and line material is in the most active demand. Examination of the statistics on heavy engineering construction appearing on page 837 shows that the year suffers no loss in comparison with 1926 and that the let-down in construction which some have feared has not developed. Electrification of textile mills in the Southeast steadily progress. One order reported was received from a textile mill in the Carolinas for motors and control equipment amounting to $20,000. The United States Steel Corporation reports a decline of 43,979 tons in unfilled orders on March 1, but it is believed that this figure is not so significant as formerly, owing to the practice of buying only for immediate requirements.

In New England an increase is noted in inquiries for power units, particularly motors of large capacity and turbo-generators, although buying is slow in most lines. Wire, pole-line supplies and new-construction materials are foremost in demand. Industrial buying is favorable in the New York district, but central-station buying continues inactive. Satisfactory sales in the Southeast are made up of small orders. Transformers are in active demand, and purchases of line-construction materials continue in good volume. Sales in the St. Louis district are about on a par with those of 1926, but the buying season has been backward owing partly to the unusually heavy rainfall. Favorable business prevails in the Middle West with a fluctuation evident. Several large inquiries for cable and wire are reported by manufacturers. On the Pacific Coast weather hampers current business. Power company buying of line material is good, and pump and motor business in Yakima, Wenatchee and Okanogan for fruit-orchard irrigation continues exceptionally good.

### Copper Sales Improve—Prices of Most Metals Lower

The long-deferred buying movement in copper showed signs of materializing on Wednesday, when a good tonnage was sold at 13 cents for Eastern deliveries. One or two resale lots of copper went for slightly less, and consumers near the refineries also get their customary concessions. On Wednesday the statistics released showed a decline in refined stocks at the end of March from 105,020 tons to 102,637 tons, and of blister from 272,219 tons to 260,225 tons, rather surprising in the case of blister. The rate of both domestic and export shipments improved by about 4 per cent over February. Refinery production rate decreased by close to 7 per cent, and smelter production by almost 9 per cent. Zinc continues quiet at slightly lower prices, though the volume of sales was better than a week ago. Lead perhaps looks the weakest of any of the non-ferrous metals at the moment, business having been very poor lately. Gradual recession in prices occurred in the St. Louis district. As early as last week Friday sales were made at 6.95 cents. On Wednesday of this week any reasonable quantity could be had for 6.90 cents.

Tin has been a little lower for spot offerings, and consumers have bought somewhat more liberally for forward as well as prompt.

NEW YORK METAL MARKET PRICES

| | April 6, 1927 Cents per Pound | April 13, 1927 Cents per Pound |
|---|---|---|
| Copper electrolytic | 13–13.05 | 13 |
| Lead, Am. S. & R. price | 7¼ | 7¼ |
| Antimony | 12¼ | 13¼ |
| Nickel, ingot | 35 | 35 |
| Zinc spots | 6.85 | 6¾ |
| Tin, Straits | 69¼ | 68 |
| Aluminum, 99 per cent. | 26 | 26 |

Base copper price April 13, 1927, 15 cents.

### Activity in Inquiries Presages Buying in New England Soon

Marked increase in inquiries for power units is reported in the New England district, with the activity dominant in turbo-generators and motors. An increase in the number of requests for quotations on motors of the larger capacities is recorded. Actual buying is slow in almost all lines, and sales of small motors continue at a low level. Central-station orders cover materials in small lots with few outstanding purchases reported. Wire, pole-line supplies and new-construction materials are foremost in demand.

Negotiations are under way for a number of electric delivery trucks. Sales of that commodity last year covered 33 units for the Boston district alone, according to one company. This was a slight increase as compared with the previous year, while the volume for the coming year is expected to be greater. Industrial-heating manufacturers are active. Last year one central-station company added 1,679 kw. of industrial heat to its load, and many inquiries for furnaces are being received.

### Industrial Buying Favorable in New York District

Conditions in the New York district are substantially unchanged. Central-station buying continues inactive, with no increase reported in the volume of inquiries being received by manufacturers. One central-station company is in the market for about $20,000 worth of transformers. Industrial business is more favorable, numerous orders for small transformers for industrial uses being reported, together with a continuation of the excellent demand for general-purpose motors in sizes from 3 hp. to 10 hp. Further improvement is also reported in the market for control apparatus. Jobbers say there is a fair demand for general supplies, but appliance sales are not very active.

### Satisfactory Sales in Southeast Made Up of Small Orders

Generally satisfactory business prevails in the Southeast. Transformers continue in active demand, and in addition to a good volume of small and moderate-sized orders one manufacturer reports the sale to a central-station company in the Carolinas of transformers and switching equipment amounting to $28,000, while the purchases of small power and distribution transformers by a power company in Georgia during the past ten days have totaled $18,500. Central-station purchases of line-construction materials continue in good volume, one company having ordered in the past ten days wire amounting to more than $10,000 and cable aggregating $13,000, besides $4,500 worth of poles and cross-arms and insulators amounting to $3,700. Switching equipment sales are reported active, one company having ordered in the past ten days oil circuit breakers amounting to $12,500 and disconnecting switches totaling $3,500. Safety switches are in steady demand, but few large individual orders have been received lately, the largest reported last week amounting to $3,200 from the Florida territory.

An interesting industrial order reported was from a textile mill in the Carolinas for motors and control equipment amounting to $20,000. There was also reported a reasonable amount of substation equipment orders, with a considerable quantity of additional business in this line in immediate prospect. Among the purchases made recently by municipalities was one from a Georgia town for electrical fire-pumping equipment costing $12,500.

### Sales in St. Louis About on Par with Those of 1926

The volume of business in the St. Louis district has been barely up to that for the same period last year, and the backward season with unusual amount of rainfall is still having an effect, especially in holding back the placing of orders for transmission line as well as building material. The average number of orders for medium-sized motors and control apparatus has been booked. Manufacturers of electrical advertising signs report that while their business has not been marked by any particular activity the volume is good and is just about keeping on a par with that for the same period of last year. A contract, amounting to $16,000, was closed for a grinding mill with 250-hp. motor and patented type of rope drive by a large company in St. Louis making paint products. Two orders, totaling about $3,000, for 33,000-volt outdoor substation switching equipment have been placed by a power company in northeast Arkansas.

### Weather Hampers Current Business on Pacific Coast

Weather conditions on the Pacific Coast have hampered business but will probably result in increased purchases in the fall. Power-company buying of line material is good and includes three carloads of cross-arm braces, eight carloads of poles for the Vallejo, Salinas and Bay districts, and material for a 30-mile, 11,000-volt line from Truckee to Meeks Bay, Lake Tahoe, valued at about $25,000. Jobbers report an unusual number and variety of bids for material for use by the state.

The volume of sales in the Puget Sound district was good. It consisted mainly of small orders. The city of Seattle purchased $18,000 worth of distribution transformers and the sale of sixteen 15-hp. motors to a large lumber mill in Everett is reported. Pump and motor business with dealers in Yakima, Wenatchee and Okanogan for fruit-orchard irrigation continues exceptionally good, and one Seattle jobber believes that sales of his firm will exceed 100 outfits more before July 1. The Town Council of Grandview has authorized the installation of an electric pumping system for water supply. Plans have been made for the expansion of substation facilities, reconstruction and improvement of city and county distributing systems and extensions of rural connections costing $237,000 in and near Everett in Snohomish County. Establishment of a small municipal lighting plant is being considered by the town of Morton, near Tacoma. Plans for a proposed five-million-dollar soda pulp and paper plant in Bellingham have been announced by the Bloedel-Donovan Company, the largest lumber mill operators in the Northwest.

### Favorable Business Prevails in the Middle West

Business in the Middle West continues favorable, but many varied conditions are noticeable. Reports from the railroad companies indicate a volume movement of commodities, and the steel industry is operating at a high level. There is considerable variance among industrial plants, some industries operating full time while others are unusually slow. The utility companies are apparently not affected much by the fluctuating business, although some tightening up is noticeable. Considerable construction work is going on, particularly in the Great Lakes region, and purchasing of apparatus continues in good volume. An order was placed for 500 distribution transformers ranging from 25 kva. to 100 kva. Several large inquiries for cable and wire were reported received by manufacturers and there has been a large demand for maintenance materials.

The volume of business transacted by the jobbers parallels general business. Generally the condition is spotty. In Michigan, Minnesota, Iowa and southern Illinois business is slow. In Wisconsin, northern Illinois and Indiana conditions are better, although hand-to-mouth buying is universal.

# Activities of the Trade

### Westinghouse Uses Arc Welding in Motor-Generator Construction

Arc welding has been applied extensively to the construction of generators and motors by the Westinghouse Electric & Manufacturing Company, and its employment in the building of the 16,000-lb. lower bearing bracket for the large Conowingo waterwheel generators which the company is building furnishes an impressive example of its use. Each of the three 40,000-kva. vertical machines is 37 ft. in diameter and weighs over 1,000,000 lb. The lower bearing bracket is a large cross-shaped structure 24.9 ft. in diameter, with a 68-in. opening at the center for the shaft. This structure is built up of 24-in. standard girders, and all joints are arc-welded. Heavy cast-steel brackets at the center opening are also welded on, round holes being cut in them to give greater welding periphery.

Generators of this size are built at infrequent intervals, but the Westinghouse company has embodied electric welding also as standard construction in an extensive line of bedplates for motor generators, ranging in size from 75 kva. to 25,000 kva., and a machine of the latter size is now being con-

structed. As in other examples of electric welded design there is a very material saving in weight.

## Safety Cable Company Acquires New Properties

The properties of the American Insulated Wire & Cable Company and the Brenner-Mervis Company, both of Chicago, have been acquired by the Safety Cable Company, 114 Liberty Street, New York. The American Insulated Wire & Cable Company manufactures weatherproof copper wire, bare copper wire and magnet wire, and its officers are: Nathan T. Brenner, president; L. G. Brenner, vice-president; Norman Brenner, treasurer, and M. B. Mervis, secretary and sales manager. The Brenner-Mervis Company is a manufacturer of copper rods and wire.

In the latter part of 1925 the Safety Insulated Wire & Cable Company of New York and the Phillips Wire Company of Pawtucket, R. I., formed a consolidation which has since been operating as the Safety Cable Company. The A-A Wire Company of Harrison, N. J., was acquired by the Safety Cable Company soon after the consolidation was effected.

**The Waage Electric Company**, 5100 Ravenswood Avenue, Chicago, manufacturer of electrical appliances, has awarded a contract for the proposed one-story addition to its plant, estimated to cost about $25,000.

**The P. A. Geier Company**, Cleveland, manufacturer of the Royal electric cleaner, announces the appointment of Walter B. Fulghum as vice-president in charge of sales. Mr. Fulghum was formerly general sales manager of the Crosley Radio Corporation of Cincinnati. Mr. Fulghum's duties will be those of assistant executive to Frank J. Gottron, general manager of the electric division of the company, and will in no way alter the status of Carl M. Randel, director of sales, or James L. Mahon, merchandising manager.

**The Ohio Brass Company**, Mansfield, Ohio, announces that David H. Moore, electrical engineer and assistant to the secretary of the company since the fall of 1925, has been appointed district sales manager with headquarters at 50 Church Street, New York City.

**The Bury Compressor Company**, Erie, Pa., announces that Earl E. Knox, who for 20 years has represented the company in the Pittsburgh district, has been appointed general sales manager in charge of sales and advertising and will be stationed at Erie.

**The Fitzgerald Manufacturing Company**, Torrington, Conn., manufacturer of "Star-Rite" appliances, announces the "Star-Rite Junior" waffle iron at a retail price of $3.95. The company states that this iron is not intended to replace the standard-size waffle iron but to open up an absolutely new market.

**The W. Green Electric Company**, New York, manufacturer of polishing, buffing and grinding motors and electroplating machines and generator sets, announces its removal to 182 Broadway, corner of John Street, where it will have a showroom devoted to the exhibition of its equipment and a special department for demonstrating the correct methods of electroplating.

**The Burndy Engineering Company, Inc.**, 10 East Forty-third Street, New York, announces that in response to numerous requests it is now able to furnish Anaconda copper tubing in all sizes and weights as well as flat and round bars with the Burndy connectors it manufactures.

**The Chicago Fuse Manufacturing Company**, Laflin and Fifteenth Streets, Chicago, manufacturer of "Union" and "Gem" fuses and conduit fittings, announces the appointment of W. A. Wilcox as district sales manager, with headquarters at St. Louis. Mr. Wilcox will have charge of sales over southern Illinois, eastern Missouri, western Tennessee, Mississippi, Arkansas and Louisiana. Mr. Wilcox was formerly associated with the Economy Fuse & Manufacturing Company for more than eight years.

**The Cleveland Wrought Products Company**, Cleveland, has placed on the market a stamped electric conduit bushing which is cadmium-plated and for which unusual corrosion-resisting properties are claimed.

**The Triumph Electric Corporation**, Cincinnati, announces the appointment of the Handlan-Buck Manufacturing Company as distributor of Triumph motors in the St. Louis territory.

**Baker & Spencer, Inc.**, 117 Liberty Street, New York, has been organized by W. H. Baker and C. G. Spencer to engage in the general practice of engineering and construction.

**The Niagara Metal Stamping Corporation**, Niagara Falls, N. Y., manufacturer of equipment for stamping poles, announces that George O. Benson, formerly sales manager, has been elected vice-president in charge of sales.

**The Baker Steam Car & Manufacturing Company**, Pueblo, Col., will start the work of enlarging its factory in the near future in order to provide for increased production of Baker oil burners. W. I. Allred, vice-president, and J. J. Zielke, secretary, recently acquired a controlling interest in the company through the purchase of the Martin Walter stock.

**The Lamson Company**, Syracuse, N. Y., announces the appointment of the following distributors for its "Ice Maid" refrigerator. The Economy Electric Company will act as distributor in Worcester, Mass.; the Times Appliance Company will handle the "Ice Maid" in metropolitan New York, and the Great Western Stove Company will act as distributor in the state of Iowa, Kansas, and Nebraska. The Lamson Company previously had its own New York branch under the management of Willard Hall, who now becomes manager of the major devices division of the Times Appliance Company.

**The H. E. Holbrook Company** opened new quarters with increased space for display at 89 Federal Street, Boston, on April 1. The H. E. Holbrook Company represents the Walker Dishwasher Corporation, the Iroquois Electric Refrigeration Company and various domestic equipment manufacturers in the eastern Massachusetts territory. In the afternoon of the opening day an informal reception to the trade was held, with president H. E. Holbrook as host, followed by a dinner at the Boston Chamber of Commerce and a visit to the Boston "home beautiful" show in the evening.

**The Crocker-Wheeler Electric Manufacturing Company**, Ampere, N. J., has issued a booklet, entitled "The Crocker-Wheeler Contribution to American Civilization," in which it calls attention to the new members of the Crocker-Wheeler family, consisting of four new lines of direct and alternating-current general-purpose motors. The booklet also contains a number of illustrations showing representative plants in various industries and institutions which contain Crocker-Wheeler equipment.

**The McGraw Electric Company**, Thirteenth Street and Capitol Avenue, Omaha, Neb., jobber, held an informal opening and house warming in its new quarters during the week of March 28 to April 2. The building is a modern six-story and basement, reinforced-concrete structure, containing more than 70,000 sq.ft. of floor space.

**The Moore-Handley Hardware Company**, agent-jobber for the Westinghouse Electric & Manufacturing Company in Alabama, with headquarters in Birmingham, announces that Harold W. Brown, formerly merchandising representative of the Westinghouse company in Alabama and northwest Florida, is now heading up its merchandising activities.

**The Rome Wire Company**, Rome, N. Y., manufacturer of electrical wires and cables, has taken out a permit for the erection of a one-story addition to its branch plant at 130 Clyde Street, Buffalo, estimated to cost about $65,000.

**Michigan Refrigeration, Inc.**, Grand Rapids, Mich., recently organized, has acquired the former local plant of the Cheney Talking Machine Company, and will remodel and equip a new plant for the manufacture of electric refrigerating equipment, to be known under the trade name of "El-Frig-Ette."

**The Belden Manufacturing Company**, Chicago, manufacturer of insulated wires and cables, has awarded a contract for the erection of the first unit of its proposed new plant at Richmond, Ind., estimated to cost about $225,000, with equipment. It is scheduled to be ready for occupancy on Oct. 1, when the company will remove a portion of its Chicago plant to this location. Two other units will be erected at the Richmond site, designed to provide for the remainder of the Chicago works.

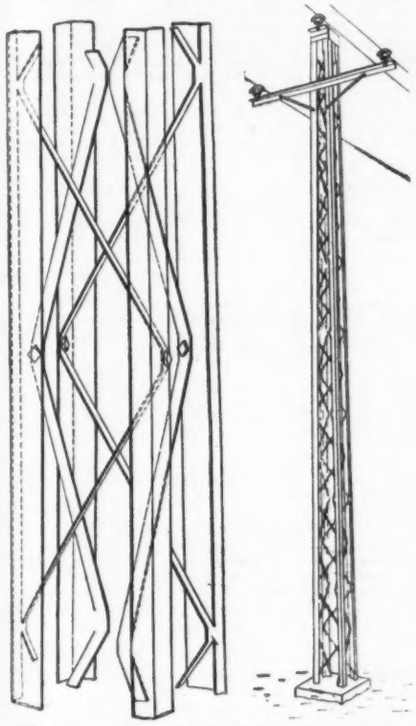
**The General Electric Company**, which has been operating a plant at Taunton, Mass., for a number of years for the manufacture of small motors, has started moving the machinery and equipment to its Riverside plant at Lynn, where the work will be combined with operations at that plant.

**The Westinghouse Electric & Manufacturing Company** has received an order from the Chicago, South Shore and South Bend Railroad for two 53-ton electric locomotives costing about $70,000.

# New Equipment Available

## Steel Poles

A new line of steel poles has been designed by the Walter Bates Steel Corporation, Gary, Ind., and they are said to combine strength, light weight, durability, simplicity and economy. The new poles are either square or rectangular in section, and each consists of four individual units, a unit being shear-shaped from a standard structural angle to form one leg and set of lacing, as shown in the illustration.



PHANTOM VIEW OF POLE SHOWING ONE METHOD OF LACING. A COMPLETED POLE IS SHOWN AT THE RIGHT

The single lattice poles with internal lacing are particularly adaptable to city installations where a narrow base is an essential item. These poles can be supplied in lengths up to and including 45 ft. without splices. The cross-lattice poles with external lacing are for cross-country lines where base dimensions are not limited. The standard lengths of these poles are up to and including 60 ft. The cross-lattice poles with a combination internal and external lacing are another type of pole which may be used in cases similar to the last mentioned and are available in the same lengths.

## Line Fuse

A fuse designed for use on circuits of 4,400 volts and mounted in a porcelain housing has been placed on the market by the Line Material Company, South Milwaukee, Wis. The unit embodies the same principle as the company's larger fuse, the P66C1. The fuse cartridge is made of two non-carbonizing tubes, one within the other, with a hole in the side through which the fuse link passes. When the fuse blows the inner tube is forced downward, thus throwing the holes out of line, and effectively ruptures the arc and also any of the link which may remain. The inner tube then rests in a small bracket which acts as a telltale and indicates which fuse is blown. The heavy copper terminals are knurled into the outer tube and the lower terminals are clamped and cemented to withstand pressure and make them gas-tight. There is a substantial barrier between the upper and lower contact and also below the lower contact. The contact clips are mounted on wet-process porcelain insulators, which is said to insure ample insulation.

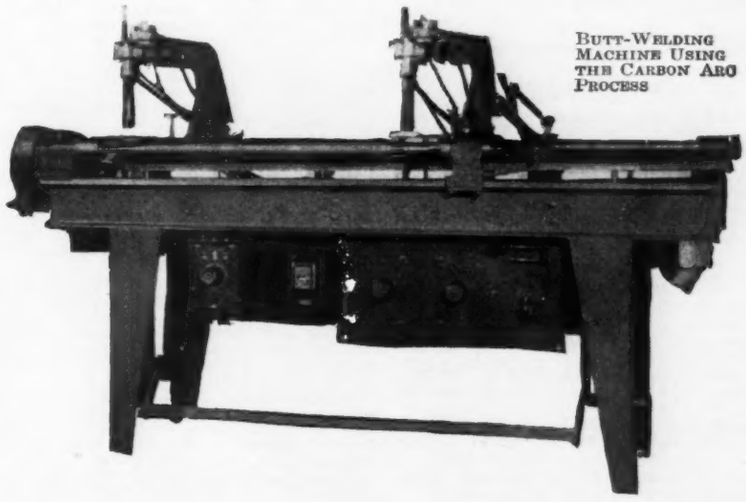
## Totalizing Demand Relay

A device for totalizing the simultaneous demands of several individual circuits has been developed by the General Electric Company. The new relay, type DT, totalizes the demand from several watt-hour meters and allows the summation to be transmitted to one demand meter, which can be of any contact-operated type. The relay can be furnished in forms suitable for totalizing the demand of any number of circuits from two to eight. In size, as in appearance of the case, it is similar to the type PD demand meter.

## Butt-Welding Machine

The Lincoln butt-welding machine shown in the illustration is a further application of the machine-driven carbon arc to the problems of welding, and has been placed on the market by the Lincoln Electric Company, Cleveland. The manufacturer claims that the arc butt welder is not an alternative method of doing butt welding, but is the solution of a class of butt-welding problems which the resistance welder cannot solve. As an instance of this, a plug may be welded into the end of a tube with the arc butt welder very easily.

The machine illustrated welds both ends of a tube at once by use of the two automatic heads. A similar instance of applicability of the arc butt welder is that of welding a small-diameter round bar to a large-diameter bar. With the arc butt welder the welding heat is applied to the joint by the carbon arc and the bars are revolved to distribute the heat uniformly. Pressure is applied to squeeze out the slag and complete fusion. The motor-generator set used supplies direct current to the arc at 40 volts to 60 volts. The motor used is a standard induction motor.



BUTT-WELDING MACHINE USING THE CARBON ARC PROCESS

## Demand-Limiting Device

A demand-limiting device for automatically interconnecting range and water-heater circuits, known as the "Hotpoint peak limiter," has been placed on the market by the Edison Electric Appliance Company, Inc., 5600 West Taylor Street, Chicago. A special form of thermal relay is used in the unit, which is intended for use with any three-wire, 115/230-volt range with a connected load not greater than 9 kw. The unit is installed at the service-entrance switch in the same manner as a watt-hour meter, and it is said that the switch can be easily installed even in existing installations.

**Small Rotary Converter.** — A small specially designed rotary converter in which the voltage and frequency is held within 5 per cent variation regardless of the power factor or load has been placed on the market by the Fidelity Electric Company, Lancaster, Pa. The units are made in 300-watt, 600-watt and 1,200-watt sizes and are available for operation on 110-volt or 220-volt direct current to deliver 110 volts, 60 cycles, single-phase.

**A 45-Deg. Circular Divergence Lens.** —A new floodlight lens known as a 45-deg. circular divergence lens is being produced in 23-in. diameter optical glass by the Pyle-National Company, Chicago. The lens is designed to work with the minimum light absorption and diffusion and to spread an absolutely uniform beam across a 45-deg. arc. Other new features include several refinements in the adjusting and locking mechanisms of the projectors so that they may be swung and turned into a convenient position for outside cleaning or maintenance without altering the permanent set of the adjustment and focusing.

# New Trade Publications

MANOMETERS.—Bulletin No. 131 issued by the Bacharach Industrial Company, 7000 Bennett Street, Pittsburgh, covers the various types of the Bacharach manometers, all of which may be used for either pressure, suction or differential pressure. The different types are illustrated, and tables give the range and dimensions of the various sizes.

CUTOUTS FOR ORNAMENTAL STREET-LIGHTING UNITS.—The General Electric Company is distributing leaflet GEA-469A, describing the "Novalux" cutouts, forms R and M, for ornamental street-lighting units.

WIRING DIAGRAMS.—The Reynolds Electric Company, 2650 West Congress Street, Chicago, is distributing bulletin No. 45, containing wiring diagrams for flasher "hook-ups."

CONDUIT FITTINGS. — The Crouse-Hinds Company, Syracuse, N. Y., is distributing folder No. 50, covering its new "Obround" condulet, form 7.

MAGNET WIRE.—The Maring Wire Company, Muskegon, Mich., is distributing catalog No. 27, covering the entire line of Maring magnet wire. It contains numerous tables and data giving information regarding magnet wire and its use. Illustrations showing the various stages of the manufacture of magnet wire are included.

HAND TACHOMETERS.—The O. Zernickow Company, 15 Park Row, New York City, is distributing a booklet covering the "O-Z" hand tachometers. It contains a sectional view of the "O-Z" hand tachometer and also instructions for its use. The bulletin also calls attention to the "O-Z" stationary tachometers.

LINE INSULATORS.—Bulletin No. C-61 issued by the Corning Glass Works, Corning, N. Y., describes and illustrates its "Pyrex" transmission and distribution line insulators. Specifications of the various types of insulators are included. An illustration shows the result of a power arc test, 1,800 amp. for five seconds, on a Pyrex insulator.

EXTERIOR LIGHTING FIXTURES. — The Smyser-Royer Company, York, Pa., has issued catalog J, covering its line of exterior lighting fixtures, including lamp posts, brackets and lanterns, for public buildings, street-lighting, estates, private homes, etc. It contains many illustrations showing the various types of fixtures and typical installations.

INSULATION RESISTANCE-MEASURING INSTRUMENTS.—A booklet, "What Constitutes Safe Insulation," including an explanation of the "Megograph" and its contribution to modern electrical maintenance, has been issued by Herman H. Sticht & Company, 15 Park Row, New York. The booklet discusses the subject of insulation resistance and by citing actual records points out the value of making insulation measurements.

NICKEL ALLOY STEEL.—A bulletin entitled "A Hundred Years of Steel Improvement" has been issued by the International Nickel Company, Inc., 67 Wall Street, New York. The bulletin calls attention to the use of alloy steels in the various industries. Copies of two of the company's advertisements, covering a historical campaign it is conducting, are included.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency are desired in Manila, Philippine Islands (No. 24,933), for electrical apparatus.

An agency is desired in Melbourne, Australia (No. 24,928), for electrical appliances and radio sets.

Purchase or agency is desired in Bagdad, Iraq (No. 24,971), for electric automobile lamps.

An agency is desired in Durban, South Africa (No. 24,922), for electrical refrigerators.

An agency is desired in Barcelona, Spain (No. 24,940), for electrical refrigerators.

Purchase is desired in Marseilles, France (No. 24,967), of a floating electric crane of 125 tons capacity.

Purchase is desired in Berlin, Germany (No. 24,960), of temperature measuring and recording instruments.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## *New England States*

BEVERLY, MASS. — The City Building Commission is considering the construction of a building for fire-alarm headquarters, to cost about $150,000.

BOSTON, MASS.—Plans have been filed by W. F. Schrafft & Sons, 549 Main Street, for the construction of a power plant at their candy factory, to cost about $100,000.

NEW HARTFORD, CONN. — The New Hartford Electric Light Company is planning to extend its service to Barkhamsted.

NEW HAVEN, CONN.—The United Illuminating Company will begin work this spring on the construction of an additional steam-operated electric plant on Grand Avenue, to cost about $3,250,000. The equipment will include three turbo-generator units of about 32,500 kw. capacity, boilers, etc. Westcott & Mapes, New Haven, are engineers and architects.

NORWICH, CONN.—The State Legislature has appropriated $30,000, for extensions and improvements to the power plant at the local State Hospital.

## *Middle Atlantic States*

BALDWINSVILLE, N. Y.—The Seneca River Power Corporation has applied to the Public Service Commission for permission to extend its transmission line in the town of Hastings and for approval of a franchise granted by the Town Board.

GOUVERNEUR, N. Y.—R. E. Stockham, who has been in charge of building the municipal electric plant here for the past two years has asked for a release from his contract for completing the work. This calls for the construction of the third and west section of the concrete dam. The Municipal Commission, it is expected, will finish the work.

LANCASTER, N. Y.—The Dewey & Lancaster Light, Power & Conduit Company has contracted with the Town Boards of Varysburg and Johnsonburg to furnish street-lighting service in both towns.

NEW YORK, N. Y.—All bids submitted for a refrigerating plant for the New York House of Refuge, Randall's Island, have been rejected by the Superintendent of Standards and Purchases, Albany. New bids, it is understood, will soon be asked for.

QUEENS, N. Y.—The Long Island Railroad Company, Pennsylvania Terminal, New York, is planning the electrification of its Hoban yards, between St. Albans and Hollis, Queens, in connection with an enlargement program to cost $1,000,000.

ROCHESTER, N. Y. — Permission has been asked by the Rochester Gas & Electric Corporation to erect a central steam heating plant at Mount Road Boulevard, to cost about $110,000.

SONYEA, N. Y.—Bids will be received by the Commissioner of Mental Hygiene, Department of Mental Hygiene, Capitol, Albany, N. Y., until May 4, for construction, sanitary and electric work, of admission building, nurses' home, house for first assistant physician, staff buildings "A" and "B," teachers and student teachers' buildings, Craig Colony, Sonyea, N. Y.

SYRACUSE, N. Y. — Plans have been submitted by the Rapid Transit Commission to the Board of Park Commissioners for the installation of an ornamental lighting system on Central Parkway. Traffic lights will also be placed at street intersections on the Parkway.

SYRACUSE, N. Y.—Work will begin at once on extensions of the ornamental lighting system through East Genesee Street to Ferris Avenue, also in Onondaga Park through Onondaga, Bellevue and Summit Avenues, and in several other streets, according to the plans of Harvey N. Smith, consulting engineer, for the bureau of gas and electricity.

YONKERS, N. Y.—Plans have been filed by the Alexander Smith & Sons Carpet Company for the construction of a power plant at its mill, to cost about $50,000.

NEWARK, N. J.—Bids will be received by the Passaic Valley Sewerage Commissioners, 24 Branford Place, Newark, until April 19, for electric wiring and lighting system in basin galleries and elsewhere in Section 4, Passaic Valley Sewerage Works, including poles, fixtures, etc. J. Ralph Van Duyne is chief engineer.

SAYREVILLE, N. J.—The Eastern New Jersey Power Company has secured permission to take over and operate the Sayreville Electric Light & Power Company. Extensions in transmission lines are contemplated.

LEWISTOWN, PA.—The City Council is considering the installation of a municipal fire-alarm system.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C,. until April 19, for parts for storage batteries (Schedule 7023).

PHILADELPHIA, PA.—Plans have been filed by the Department of City Transit for the construction of a substation on Mount Vernon Street, near Watts Street, to cost about $200,000.

PITTSBURGH, PA.—Plans have been filed by the Duquesne Light Company for the construction of a substation at West Liberty and Saranac Avenues, to cost about $32,000.

SHARON, PA.—The Carnegie Steel Company has appropriated $1,200,000 for improvements to the Farrell works, of which more than $400,000 will be used to install a turbo-blower and a large electric generator for the blast furnaces.

WEISENBERG, PA.—The Metropolitan Edison Company, Reading, which purchased the property of the Weisenburg Township Electric Light & Power Company, plans extensions in transmission lines in this section.

SPRIGG, W. VA. — The Appalachian Electric Power Company, Bluefield, has acquired a local site on which it proposes to build a steam-operated electric power plant. A transmission line will be built.

RICHMOND, VA.—Work will start at once by the Appalachian Electric Power Company on the rebuilding of its transmission lines from Reusens to Lynchburg, to increase the capacity to 20,650 kilowatts.

SCOTTSBURG, VA.—Surveys are being made by the Virginia Electric & Power Company, Richmond, with a view of extending its transmission line from Clover to Scottsburg to furnish service here.

WASHINGTON, D. C.—Plans will soon be drawn for the proposed power plant for the Bureau of Standards, to be located at Connecticut Avenue and the Pierce Mill Road, N. W., for which appropriation of $200,000 has been granted.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until April 19, for one electric motor with control equipment for submarine base (Schedule 7016).

## *North Central States*

DETROIT, MICH.—The Detroit Edison Company plans to build an addition to its substation on Hart Avenue, and also to erect a new substation on Pulford Avenue to cost about $225,000.

IRONWOOD, MICH.—Armour & Company, Union Stock Yards, Chicago, plan to install an automatic electric refrigerating plant in a new local storage building.

MUSKEGON HEIGHTS, MICH. — Plans have been prepared by the Consumers Power Company, Jackson, for a service building here, to cost about $60,000.

CHILLICOTHE, OHIO. — Improvements contemplated by the Chillicothe Electric Railway, Light & Power Company during 1927, include extensions to its high-tension transmission lines, substations and distribution lines.

CLEVELAND, OHIO — Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until April 22 for extensions and improvements to the fire-alarm system of the city.

CLEVELAND, OHIO—Separate bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until April 22 for series multiple transformers, for ornamental "Whiteway" lamp standards and for lead-covered cable for the Division of Light and Power.

SPRINGFIELD, OHIO — The board of trustees of Wittenberg University is considering the construction of a power plant at the university, to cost about $55,000, H. D. Smith, 207 East State Street, Columbus, is engineer.

MURRAY, KY.—The Kentucky-Tennessee Light & Power Company, Bowling Green, is planning to erect a transmission line from Paris, Tenn. to Murray and vicinity, with extensions to Whitlock and Haxel, to cost about $100,000.

ANDERSON, IND.—The Anderson Engine & Foundry Company, 215 Jackson Street, plans to build an addition to its power plant, 30 x 50 ft., at Second and Jackson Streets.

JASPER, IND.—The Jasper Ice & Cold Storage Company plans to build an electrically-operated ice plant.

LAWRENCEBURG, IND. — The Dearborn-Ripley Light & Power Company, recently formed by Walter G. Decker and associates, plans to erect a transmission line for service in a number of communities in the northern part of Dearborn County. A substation will be built.

LOGANSPORT, IND.—The installation of an ornamental lighting system in the downtown section of the city, to cost about $50,000, is under consideration by the Board of Works.

ALTON, ILL.—Plans have been prepared for the installation of an ornamental lighting system on portions of Broadway, Market, Piasa, Belle, State, West Third and Fourth Streets, consisting of 266 standards mounted with 600-cp. lamps, to cost about $59,870.

CAIRO, ILL.—The City Council is considering the installation of an ornamental lighting system on Washington Avenue, from Second to Twenty-first Street. George F. Dewey is city engineer.

CHICAGO, ILL.—Plans have been filed by the Commonwealth Edison Company for an addition to its testing laboratory at Addison and California Streets. H. Von Holst, 79 West Monroe Street, is architect.

FOWLER, ILL. — The Central Illinois Public Service Company, Springfield, has petitioned the Illinois Commerce Commission for authority to take over the Fowler electric light plant. Distribution systems are to be built in Fowler and Tioga to be served from the Central Illinois transmission line at Lima.

KEWANEE, ILL.—The Kewanee Public Service Company contemplates extensions and improvements in its electric distribution system, to cost about $40,000.

PEORIA, ILL.—The Central Illinois Light Company is considering the construction of an office and operating building at the foot of Harrison Street, to cost about $125,000.

GREEN BAY, WIS.—Surveys are being made by the Wisconsin Public Service Corporation with a view of developing Roaring Rapids on the Peshtigo River and building a large hydro-electric plant.

GREEN LAKE, WIS.—Surveys are being made by the Wisconsin Power & Light Company, Madison, for the erection of a transmission line from the south shore of the lake to the village of Green Lake, via the new inlet road, and on to Lawnsonia, where it will connect with the Princeton-Lawnsonia line. The company also plans to raise the voltage on the line extending from Ripon to the south shore of Green Lake from 2,300 to 6,600.

NEW PRAGUE, MINN.—The City Council is considering calling a special election to submit to the voters the proposal to issue $50,000 in bonds for improvements to the municipal electric light plant.

THIEF RIVER FALLS, MINN. — The contract for extensions to the municipal power plant has been let to the McKenzie-Hague Company, Minneapolis, at $46,975.

ST. LOUIS, MO.—The Board of Estimate and Apportionment has approved an ordinance appropriating $325,000 from the lighting installation fund for the installation of lamps during 1927.

ST. LOUIS, MO.—The Union Electric Light & Power Company has filed plans for the erection of a substation at 665 Gimblin Street, to cost about $18,000.

SIKESTON, MO.—The Missouri Utilities Light & Power Company, St. Louis has preliminary plans for a local steam-operated electric power plant to cost about $40,000. It will be used for auxiliary service.

KENMARE, N. D.—The City Council has appointed a committee to secure estimates of cost of a municipal electric light and power plant.

WAHPETON, N. D.—The construction of a 4,000-hp. steam-driven electric plant in Wahpeton, to cost from $400,000 to $500,000, is under consideration by the Ottertail Power Company, Fergus Falls, Minn. The proposed plant will supply electricity to a number of communities.

ALEXANDRIA, S. D. — The Dakota Power Company, Sioux Falls, Iowa, is negotiating for the purchase of the municipal plant. If taken over the company plans to extend its high-tension transmission line here. The proposal to sell the plant will be submitted to the voters on May 3.

VERMILION, S. D.—The University Avenue Electric Power Company, recently incorporated, plans to erect a transmission line to supply electricity to farmers living north of the city. It is proposed to purchase electricity from the municipal electric plant in Vermilion to supply the service. W. S. Burr, W. J. Simons and Francis G. Hyde are the incorporators.

KEARNEY, NEB.—The City Council is considering extending the ornamental lighting system on business streets, the residential section and to include the grounds of the different ward schools.

PLATTE CENTER, NEB.—The Northwestern Public Service Company, Columbus, plans to erect a transmission line from Duncan to a point near Platte Center.

AUGUSTA, KAN.—Plans are under way by the Kansas Gas & Electric Company, Wichita, for increasing the voltage of the Augusta-Leon transmission line from 12,000 to 60,000. The company is now building a substation 2 miles west of Leon.

## *Southern States*

AILEY, GA.—The Georgia Power Company, Atlanta, will erect a distribution and street-lighting system in Ailey.

VIENNA, GA.—The City Council plans to rebuild the municipal electric light plant recently damaged by fire with loss of about $20,000.

WAYCROSS, GA.—The Ware County Light & Power Company is planning to install an ornamental lighting system on the Satilla Boulevard and Cherokee Drive.

KISSIMMEE, FLA.—The Florida Public Service Company, Orlando, which is negotiating for the municipal electric plant, contemplates extensions in its transmission lines in this section.

PANAMA CITY, FLA.—The City Council is considering the installation of an ornamental lighting system on Harrison Avenue and on the Beach Drive from St. Andrews to Millville.

PLANT CITY, FLA.—Ordinances have been passed by the City Council providing for the installation of an ornamental lighting system, to cost $25,000, and for a fire-alarm system, etc., to cost $26,000.

STUART, FLA.—Bonds to the amount of $15,000, have been voted for the installation of an ornamental lighting system in the downtown district, and $12,000, for a fire-alarm system.

KINGSPORT, TENN.—Plans are under way for the installation of a new ornamental lighting system in the business district. Street-lighting service is supplied by the Kingsport Utilities, Inc.

GREENWOOD, MISS.—The Mississippi Power & Light Company, Jackson, plans to erect a 13,000-volt transmission line from Moorhead to Greenwood, for service here. A substation will be built at Greenwood.

FLIPPIN, ARK.—The North Arkansas Power & Light Company contemplates the construction of a transmission line from Cotter, Ark.

WELDENBURG, ARK.—The Arkansas Power & Light Company, Pine Bluff, plans to erect a transmission line from Fisher, to Weldenburg by way of Harrisburg.

SHREVEPORT, LA.—The Southwestern Gas & Electric Company has purchased the electric power plants and other utilities operated by the Gulf States Utilities Company in Mooringsport, Oil City and Vivian. The new owners plan to rebuild the distribution systems in the three towns and also to erect a high-tension transmission line, about 6 miles long to Vivian, to connect the latter with its high-tension system.

ALVA, OKLA.—The Southwestern Power Company, McAlester, plans extensions to its local power plant, to cost about $50,000.

CHICKASHA, OKLA.—In addition to the erection of a 66,000-volt line from Chickasha to Lawton, the Southwestern Light & Power Company plans to erect a high-tension line from Chickasha northwest through Weatherford and Clinton to connect with the Lawton system. Sayre is to be connected by a 33,000-volt line with the main system at Carter. Several other short lines are contemplated to more thoroughly unite the system.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas & Electric Company, plans to erect a 63,000-volt transmission line from the Harrah power plant to connect with its line west of Maud. A new substation will be built at Maud. It is also planned to erect a new high-tension line from Chandler to Drumwright, 26 miles long.

SHATTUCK, OKLA.—The Oklahoma Gas & Electric Company plans to enlarge its local electric plant, reconstruction of the electric distribution system, installation of a new ornamental lighting system, and the erection of a high-tension line from Shattuck to Fargo.

AUSTIN, TEX.—The City Council plans the installation of an improved lighting system on Congress Avenue.

BIG LAKE, TEX.—The plant of the Big Lake Utilities Company has been acquired by Dr. A. S. Cochran, Los Angeles, Cal., a large stockholder of the West Texas Utilities Company. It is proposed to enlarge the plant and erect transmission lines (wood poles) to other towns in this section and to cover the oil field of Reagan County.

HARLINGEN, TEX.—At an election to be held April 27 the proposal to issue $400,000 in bonds, the proceeds to be used for street improvements and sewer, water and light extensions.

JACKSONVILLE, TEX. — The Gulf Public Service Company plans to install a 1,500-kw. generating unit at its local plant and erect a transmission line, 12 miles long to a new oil field.

MARFA, TEX.—The Central Power & Light Company contemplates extensions and improvements in its local lighting system, including the rebuilding of part of the lines.

SAN ANGELO, TEX.—The City Council is considering the installation of a fire-alarm system, to cost about $25,000.

SAN ANTONIO, TEX.—The Merchants Transfer Company, 215 Main Avenue, plans to build an ice and cold storage plant in the vicinity of the Military Plaza, to cost about $2,000,000.

TROUP, TEX.—The Gulf Public Service Company, Jacksonville, plans to erect a transmission line from Jacksonville to Troup, for local service. The plans include a substation.

## *Pacific and Mountain States*

SEATTLE, WASH.—Permission has been granted the city of Seattle by the Federal Power Commission for a hydro-electric development at Diable Canyon and Ruby Creek on the Skagit River.

SEATTLE, WASH.—The City Council is considering an ordinance authorizing an issue of $4,500,000 in bonds to finance new construction work within the city limits. It is proposed to extend the municipal distribution system to sections of the city now without electrical service, and to take off the increasing demand for service in the city.

TOLEDO, WASH. — The Puget Sound Power & Light Company, Seattle, plans to erect a transmission line, 11 miles long, east of Toledo to serve a farming district in that section.

COLUSA, CAL.—The City Trustees are considering the installation of an ornamental street-lighting system.

COMPTON, CAL.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system on Main Street, between Compton Avenue and Long Beach Boulevard, to cost about $45,000.

DELANO, CAL. — The Delano Grape Growers Products Company plans to install a refrigerating plant in connection with a proposed packing house, to cost about $90,000.

FORT MCDOWELL, CAL.—Bids will be received by the Construction Quartermaster, Fort Mason, Cal., until April 20, for a refrigerating plant at Fort McDowell.

GLENDALE, CAL.—Steps have been taken by the Broadway Business Men's Association for the installation of an ornamental lighting system on East Broadway, to cost about $20,000.

LONG BEACH, CAL.—The City Council has rejected all bids submitted for the installation of an ornamental lighting system on Seventh Street, and will soon ask new bids. The lowest bid received was $52,222.

LOS ANGELES, CAL. — The Safeway Stores, Inc., 1925 East Vernon Avenue, plans to install an electric refrigerating plant in its proposed cold storage and distributing plant. The entire project will cost about $150,000. William Mellema, Central Building, is architect.

LOS ANGELES, CAL.—The City Council has authorized the installation of ornamental lamps on portions of Wilshire Boulevard, using cast iron, bronzed standards; on Venice Boulevard and Fourth Avenue, using concrete standards.

LOS ANGELES, CAL.—The City Council has authorized the installation of ornamental lamps on Victoria Avenue, using concrete standards, and is also considering the installation of ornamental lamps on Federal and Highland Avenues.

MARYSVILLE, CAL.—The City Council is considering the installation of an ornamental lighting system on Fifth Street, from the subway to D Street.

OROVILLE, CAL.—At an election held recently the citizens have voted against a proposal to acquire the local electric system of the Pacific Gas & Electric Company to be owned and operated by the municipality.

SACRAMENTO, CAL.—The State Highway Commission, Sacramento, is having estimates of cost made for the installation of an improved lighting system on the Yolo Causeway, from Sacramento to Davis.

SAN FRANCISCO, CAL. — The Yosemite Power Company has been granted a permit by the California Division of Water Rights to use the waters of the Toulumne River at Heardin. The company proposes to build a hydro-electric plant, to cost about $5,500,000.

SAN JOSE, CAL.—The City Council is considering the installation of an ornamental lighting system on East Santa Clara Street, covering seventeen blocks. William Popp is city engineer.

SANTA ANA, CAL.—The City Council is planning the installation of an ornamental lighting system on portions of Third, Fourth and other streets.

TULARE, CAL.—The installation of a power plant is under consideration by the City Council.

BOISE, IDAHO—Application has been filed by the Salmon River Power & Light Company with the Idaho Department of Reclamation for an appropriation of 1,200 second feet of water from Salmon River. The company proposes to built a power plant in Lemhi County, to cost about $60,000.

SALT LAKE CITY, UTAH—The City Council has approved the installation of an ornamental lighting system on West Second Street and West Temple Street, to cost about $60,000.

RAY, ARIZ. — The Salt River Valley Water Users' Association, Phoenix, has authorized the erection of a transmission line between Superior and Ray, to cost about $100,000, to supply power at the plant of the Nevada Consolidated Copper Company.

BANNACK, MONT. — Plans are under consideration by the Gold Mining Company for the erection of a transmission line from Dillon to Bannack, to cost about $35,000, to supply electricity here.

LARAMIE, WYO.—Plans for the proposed local cement mill to be erected by the Monolith Portland Cement Company, Los Angeles, Cal., at a cost of about $750,000, include a power plant. It will be operated in the name of the Monolith Portland Cement Midwest Company.

DENVER, COL.—Franchises have been granted the Colorado Utilities Corporation, Denver, in the towns of Hayden, Oak Creek, Yampa, Steamboat Springs, Phippsburg and Craig, which have been approved by the Public Utilities Commission. In addition the company has been granted permission to furnish electrical service throughout the counties of Routt and Moffat, and in portions of Jackson and Rio Blanc Counties. The main plant of the company is located at MacGregor.

## *Canada*

TORONTO, ONT.—Plans are being prepared by the Hydro-Electric Power Commission of Ontario for increasing the capacity of transformer stations at Thorold, Welland, London, Preston, Stratford, St. Mary's, St. Thomas, Brant, Guelph, Hamilton and Toronto. The cost is estimated at $1,500,000.

BRYSON, QUE.—The installation of a second 25,000-hp. unit in the plant of the Ottawa River Power Company is under consideration.

# Electrical Patents

Announced by U. S. Patent Office

(Issued March 22, 1927)

1,621,512. HOLDER FOR ELECTRIC WELDING ELECTRODES; C. J. Kotchi, Chicago, Ill. App. filed Jan. 29, 1926.

1,621,518. ELECTRIC CELL WITH CONSTANT INTENSITY; J. Pellini, Marseilles, France. App. filed June 30, 1925. A two-liquid battery the current intensity of which will be constant for a predetermined time.

1,621,533. ALTERNATING-CURRENT RELAY; D. Grimes, Tompkinsville, N. Y. App. filed Dec. 29, 1921. Adapted to respond selectively to feeble alternating currents of a particular frequency.

1,621,534. PORTABLE LIGHTER; W. A. Guhman, New York, N. Y. App. filed Dec. 27, 1922. Particularly designed for use in connection with automobiles.

1,621,561. ELECTRIC SWITCH; B. E. Spero and Leon Spero, Cleveland, Ohio. App. filed May 13, 1925. Safety switch in which opening of the cover will automatically open the electric circuit.

1,621,621. FLASHER; G. L. Bossard, Loudonville, N. Y. App. filed June 17, 1925. For the intermittent flashing or lighting of electric lights.

1,621,628. THERMOSTATIC ALARM; J. J. Comerford, Philadelphia, Pa. App. filed Dec. 8, 1925. In which a thermometer is provided with contact points with which the mercury makes electrical connection as the mercury rises or falls.

1,621,673. ELECTRICAL INTERRUPTER; A. Leighton, Washington, D. C. App. filed April 23, 1926. (Granted under the act of March 3, 1883.) An instrument designed to open and close automatically an independent electric circuit by the opening and closing of a portion of another circuit. The instrument action depends upon the arrangement and mutual interaction of three bar electromagnets with the accompanying electrical circuits.

1,621,758. UTENSIL; D. E. Shaw, Milwaukee, Wis. App. filed May 17, 1922. Element of low resistivity utilizing many turns closely spaced. The element is brought into very close relation with the walls of the receptacle to be heated.

1,621,800. ELECTRIC WATER HEATER; A. Martin, Ogdensburg, N. Y. App. filed Sept. 26, 1922. In which the water to be heated is allowed to flow into the lower end of an upright container, where it is heated by direct contact with a plurality of pairs of electrodes supported in superposed relation by suitable conductors from the top of the container, which has a suitable discharge nozzle for the escape of the heated water.

1,621,847. AUTOMATIC DOOR CLOSING AND LOCKING MEANS; J. B. McCutchen, Bakersfield, Cal. App. filed Sept. 3, 1924. Burglar-alarm and trapping device.

1,621,867. TESTING JACK; J. A. Beoddy, Roanoke, Va. App. filed March 5, 1924. Used in connection with railway signalling appliances.

1,621,901. ELECTRICAL APPARATUS; W. H. Priess, Montclair, N. J. App. filed Dec. 5, 1921. Adapted for use to interconnect a low-loss high-powered radio-frequency reservoir circuit and an antenna circuit tuned to the same period.

1,621,914. ELECTRICAL APPARATUS; C. Van Rennes, Dayton, Ohio. App. filed Sept. 4, 1923. A mechanism which will cause a motor to operate periodically in either direction of rotation and which mechanism can be housed within the motor frame.

1,621,937. MOTOR; R. L. Lee, Dayton, Ohio. App. filed Nov. 24, 1923. Apparatus for preventing racing or overspeeding under light loads or under no load. A motor armature with circuits including one or more closed loops surrounding certain of the armature core teeth.

1,621,939. METER-READING APPARATUS; J. C. Lowe, Minot, N. D. App. filed Feb. 21, 1925. Means for reading meters from a remote point.

1,622,004. APPARATUS FOR CONTROLLING ELECTRIC CIRCUITS; W. Schwagermann, Yonkers, N. Y. App. filed April 1, 1922. Such as for changing the electric lighting effects in theaters.

1,622,018. ELECTROMAGNETICALLY OPERATED CIRCUIT CLOSER; C. Adler, Jr., Baltimore, Md. App. filed June 2, 1923. An electric relay structure for effecting an intermittent interruption of an electric circuit, as, for example, through a plurality of lamps, whereby to produce the effect of a waving light.

1,622,032. ELECTRICAL CONDUIT; O. A. Frederickson, Hartford, Conn. App. filed Aug. 20, 1925. Metal molding.

1,622,044. CIRCUIT CONTROLLER; J. T. Miller and M. Hanley, Chicago, Ill. App. filed Sept. 28, 1925. Adapted for use in conjunction with electric signals, as, for instance, in the immediate vicinity of fire and police stations when such vehicles come dashing out onto the street in response to calls.

1,622,080. ELECTROMAGNET; R. A. Blake, Brooklyn, N. Y. App. filed May 26, 1924. Adapted for imparting power to various mechanisms.

1,622,087. BAR HANGER FOR THE SUPPORT OF OUTLET BOXES FOR THE WIRING OF BUILDINGS; H. A. Calderwood, Pittsburgh, Pa. App. filed March 6, 1924.

1,622,089. ELECTRIC GAS LIGHTER; A. E. Carlson, Moline, Ill. App. filed Aug. 7, 1922.

1,622,142. IRRADIATION DEVICE FOR THERAPEUTICAL AND OTHER PURPOSE; F. Girard, Hanau-on-the-Main, Germany. App. filed Nov. 17, 1922.

1,622,145. GENERATOR-REGULATING APPARATUS; J. H. Hunt, Dayton, Ohio. App. filed Dec. 12, 1923. A dynamo having a permanent magnet field which co-operates with certain short-circuited windings of the dynamo armature.

1,622,185. MANUFACTURE OF ARMATURES; F. G. Dewey, Anderson, Ind. App. filed Oct. 16, 1924. The winding of armatures having open slotted cores. One of the objects is to wind the armature coils in a manner such that the leads or terminals of the coils will emerge as near as possible to the periphery of the core. To improve the manner of insulating the overlapping portions of the armature coils.

1,622,204. MAGNET FRAME FOR ELECTRIC MACHINES WITH SPLIT POLES; H. Paust, Vienna, Austria. App. filed May 25, 1926.

1,622,230. STORAGE BATTERY; G. W. Poillon, Tarrytown, N. Y. App. filed Feb. 18, 1925. Embodying a plurality of cells connected in series, with terminal posts connected at different intervals in the series by means of which a varied voltage of the storage battery may be used, according to the current desired for any particular purpose.

1,622,244. ELECTRIC AUTO-CONDENSATION PAD; W. R. Beckley, Omaha, Neb. App. filed Dec. 24, 1925. For use of physicians in administering electro-therapeutic treatments.

1,622,251. ELECTRIC ARC-WELDING MACHINE; V. A. Nelson, Portland, Ore. App. filed Dec. 1, 1922. Process of joining metal sheets of steel, iron and other ferrous materials in the manufacture of pipes, tanks and pressure vessels.

1,622,255. MAGNETIC MOTOR; J. G. Ruckelshaus, Newark, N. J. App. filed Jan. 11, 1926. Means for imparting a slow, regular rotary movement to a turntable of considerable weight by the oscillation of an armature actuated intermittently by an electromagnet to which current is conducted through an automatic circuit breaker by which the magnet is controlled.

1,622,263. ELECTRIC CIGAR LIGHTER; A. Schoeller, Frankfort-on-the-Main, Germany. App. filed May 6, 1926.

(Issued March 29, 1927)

*1,617,007. TRANSMISSION SYSTEM; F. G. Baum, San Francisco, Cal. App. filed June 20, 1922. Method of transmitting power over very long distances economically. A system which makes transcontinental transmission feasible.

1,622,282. APPARATUS FOR GENERATOR REGULATION; G. E. Hulse, New Haven, Conn. App. filed March 12, 1923. For regulating direct-current generators operating at variable speed, as car-lighting units.

1,622,304. PROCESS OF MANUFACTURING STORAGE BATTERIES; C. M. Angell, Chicago, Ill. App. filed Nov. 5, 1923.

1,622,326. ELECTRIC BED WARMER; A. T. Lister, Wichita, Kan. App. filed March 1, 1926.

1,622,333. CASING FOR ELECTRICAL FITTINGS; W. F. Meschenmoser, New Dorp, N. Y. App. filed Feb. 24, 1925. Which may be detachably connected to a floor outlet.

1,622,334. AUTOMOBILE CIGAR AND CIGARETTE LIGHTER; B. L. Metzger, Toledo, Ohio. App. filed Nov. 30, 1925.

1,622,362. BATTERY TERMINAL; A. W. Weimer and J. Smith, Geneseo, Ill. App. filed Jan. 17, 1925.

1,622,402. DRY CELL OR BATTERY; J. Smith, Brooklyn, N. Y. App. filed Sept. 9, 1921. Method of construction.

*Issued Feb. 8, 1927, but not previously recorded.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

## More Power and More Production Per Wage Earner

THE Census of Manufactures for the year 1925, a summary of which has just been made public by the United States Census Bureau, brings out the material increase both in the use of power and in the production per wage earner in the manufacturing plants of the country since 1919. Approximately 600,000 fewer wage earners were employed in 1925 than in 1919, the reduction amounting to 6.7 per cent. Compared with 1923, the decrease is 4.4 per cent.

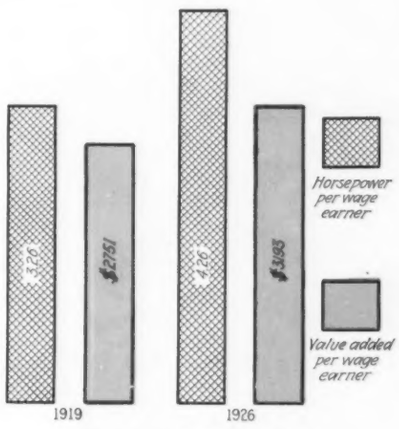
During the same six-year period the number of manufacturing plants has decreased from 213,631 to 187,386, a reduction of 12.3 per cent. The average size of the plants, in terms of number of employees, has therefore increased. Despite the diminution in number of wage earners, production increased by 8.2 per cent over 1919. Production is here taken in terms of the "value added by manufacture," which was $24,742,249,000 in 1919, dropped 26.2 per cent in 1921, rose about $1,000,000,000 above the earlier figure in 1923 and another billion during the next two years, to $26,774,566,000 in 1925. This value created by manufacturing processes is a better measure than the total value of finished output, because the products of many establishments are used as materials by other establishments, and the aggregate value of finished manufactured products ($62,705,714,000 in 1925) is therefore considerably in excess of the total value in the form in which they reach the ultimate consumer.

As might be expected in view of these contrary movements, the increased production per wage earner, which rose from $2,751 in 1919 to $3,193 in 1925, was accompanied by a considerable increase in installed primary horsepower, the actual change being from 29,297,963 to 35,735,000. This is a 22 per cent gain in six years. The growth in horsepower per wage earner is even more striking; it exceeds 30 per cent.

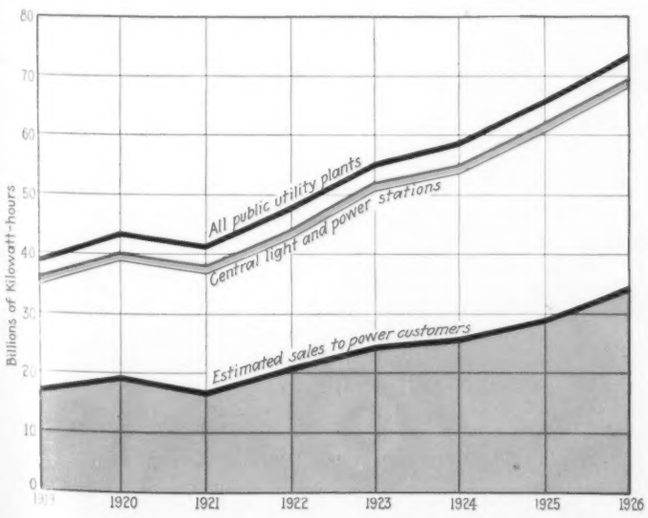
To afford a comparison of the growth of manufacturing activity with that of the consumption of electrical energy, another chart has been prepared which presents the yearly output since 1919 of public utility plants, including electric railway, Bureau of Reclamation, and some others, and of central electric light and power stations separately, as compiled by the United States Geological Survey, together with the ELECTRICAL WORLD estimate of sales to power customers. While these latter sales include the energy supplied to a great many small users not counted in the census as manufacturing establishments —the power customers, in fact, outnumber the latter three to one—a relationship does exist between the two.

The data on this point for 1925 have not yet been made public. Motors driven by purchased energy have in the past constituted a rapidly increasing fraction of the primary horsepower reported by the industries: 17.4 per cent in 1914, 31.7 in 1919, and 40.3 per cent in 1923. In 1925 the percentage must have been close to 50; at present central-station energy must drive over half of our factories.

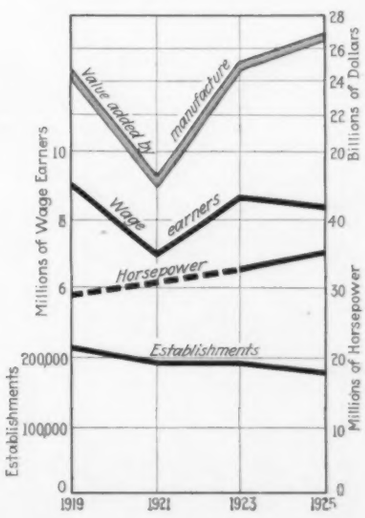
Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.




**Power and Production Per Wage Earner**




**At Left, Annual Energy Output and Industrial Energy Consumption**




**At Right, Six Years' Change in American Industry**

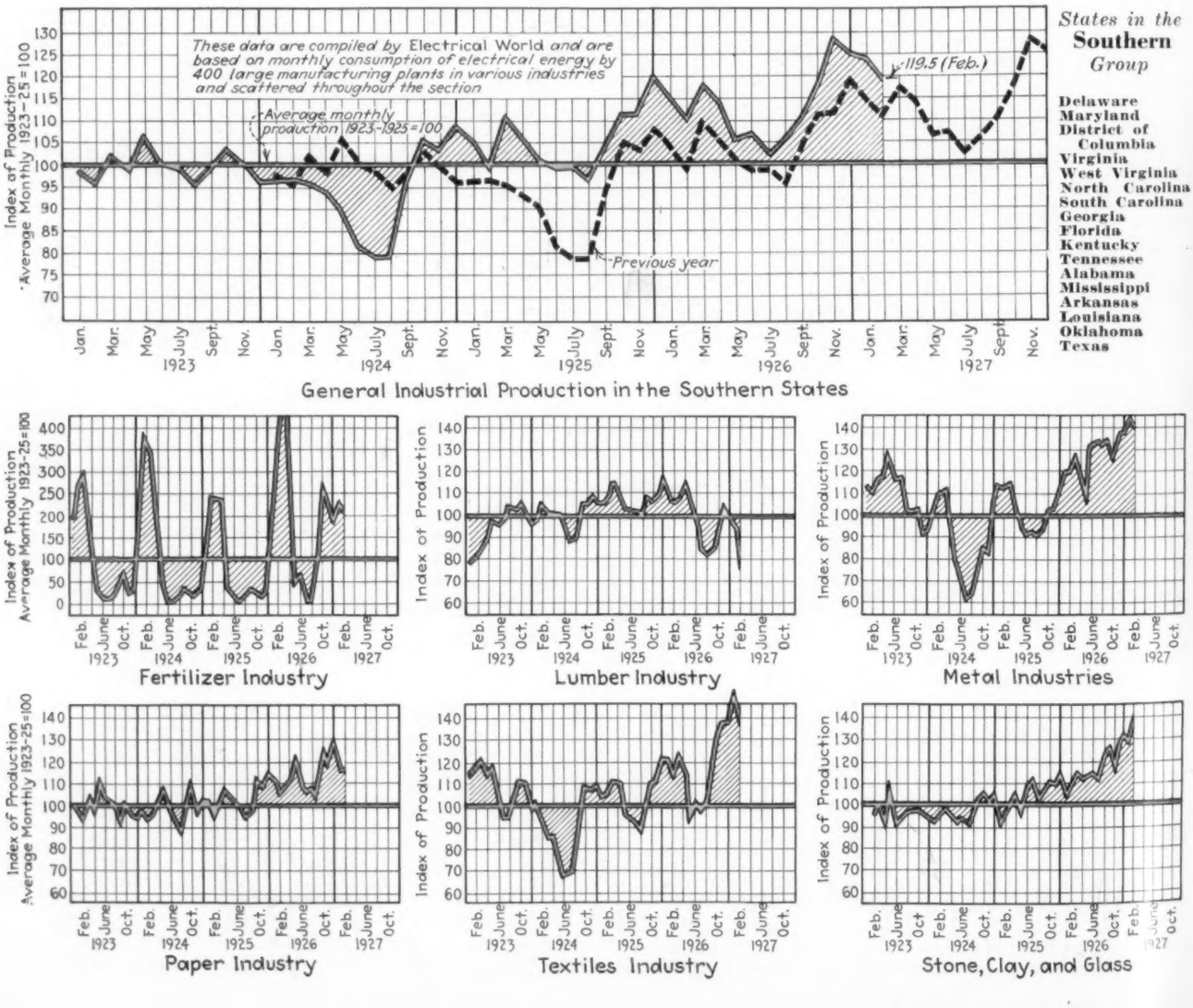
# Continued High Production in the South

THE opening months of the year found the manufacturing plants of the Southern States producing at a rate slightly above the production reported for the same months of last year. Complete reports indicate that the Southern States and the Western States are the only sections which have been operating above last year since the opening of 1927. Manufacturing plants of the Southern States, however, bear the additional distinction of having produced above the previous year ever since September, 1924. There is every reason to believe that the operations of the manufacturing plants in this section will continue above the operations reported for last year, at least through the summer months. It will take remarkable productive activities, however, to exceed the production reported during the fall months of last year. The peak of industrial production appears to have been reached in November. Both December and January reported decreased production, the February rate of production being about the same as that for January, after corrections were made for the number of working days. Such is the picture of industrial production in the Southern States as indicated by the consumption of electrical energy by the manufacturing plants in that section.

The accompanying diagrams depict very clearly the gradually increased productive activities of the Southern manufacturing plants. The metals, paper and the stone products industries have all recorded a continually general upward trend during the past two years, an increased production which has not been shared by the same industrial groups in the country as a whole. Industrially the South is undoubtedly developing faster today than any other section of the nation.

The productive operation in the metal industries of the Southern States has been continually upward since December, 1925, with the exception of one or two months. The February production of these plants was about 18 per cent over February of last year. On the other hand, in the country as a whole the productive operations of the metal industries during February were about 10 per cent under those of February last year.

Operations in the textile plants during February were slightly under those of January after corrections for number of working days are made. The February operations, however, were about 23 per cent above those of February last year and 38 per cent above the average activity for the three-year period 1923-1925. In fact, the information available indicates that the present production of the nation's textile mills is greater than at any time in the history of the industry in both the South and New England.

**"Electrical World" Barometer of Industrial Activity in the Southern States**

(Data Unadjusted for Seasonal Variation)